Energy Research and Development Division
FINAL PROJECT REPORT

WEST CARB FUELS MANAGEMENT PILOT ACTIVITIES IN LAKE COUNTY, OREGON

Prepared for: California Energy Commission
Prepared by: Winrock International

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PREFACE

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West Carb Fuels Management Pilot Activities in Lake County, Oregon is the final report for the West Carb project conducted by Winrock International. The information from this project contributes to Energy Research and Development Division's Energy-Related Environmental Research Program.

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ABSTRACT

This report summarizes work by Winrock International, Lake County Resources Initiative (LCRI), and other Lake County, Oregon partners to implement hazardous fuel reduction/biomass energy pilot activities in WESTCARB Phase II (2006-10). Wildfire is a significant source of GHG emissions in Oregon and throughout the WESTCARB region. WESTCARB developed methodologies to evaluate, validate and demonstrate the potential of reducing hazardous fuel for biomass energy to contribute to GHG mitigation and adaptation. The report describes hazardous fuel reduction pilot activities on Federal and private lands in Lake County; pre- and post-treatment measurements to quantify forest carbon impacted by treatment and/or fire; analysis of data from these pilots to determine the net GHG impact of the fuel reduction treatments; and related work by LCRI to facilitate continued hazardous fuels reduction efforts in Lake County.

Keywords: *Carbon, sequestration, hazardous fuel reduction, forest, Lake County*

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EXECUTIVE SUMMARY

Introduction

The West Coast Regional Carbon Sequestration Partnership (WESTCARB), led by the California Energy Commission, is one of seven US Department of Energy regional partnerships working to evaluate, validate and demonstrate ways to sequester carbon dioxide and reduce emissions of greenhouse gases linked to global warming.

Earlier analyses by Winrock showed wildland fire to be a substantial source of greenhouse gas (GHG) emissions throughout the region. Actions to reduce hazardous fuel loads, so as to reduce the probability, areal extent, or severity of wildfires, could result in lower net GHG emissions when compared to a baseline scenario without such treatments. Fuel reduction may also contribute to carbon sequestration by enhancing forest health or growth rates in post-treatment stands. Finally, for treatments where fuel removal to a biomass energy facility is feasible, additional GHG benefits may be created by substituting the biomass for fossil fuel rather than leaving the biomass in the forest to decompose.

Hazardous fuel reduction/biomass energy pilot activities were implemented in the two WESTCARB terrestrial pilot locations, Shasta County, California and Lake County, Oregon. These projects provide real-world data on carbon impacts of treatments, costs, and project-specific inputs to a related WESTCARB task, in which Winrock International and the WESTCARB Fire Panel are working to investigate whether the development of a rigorous methodology to estimate GHG benefits of activities to reduce emissions from wildland fires is feasible.

Project Purpose

This report provides results from the WESTCARB Phase II hazardous fuel reduction pilot activities in Lake County, Oregon. In addition we report on the revised 2010 Long-range Strategy for the Lakeview Federal Stewardship Unit, a related activity done in conjunction with the WESTCARB research efforts.

Project Objectives

The overall goal of WESTCARB Phase II is to demonstrate the region's key carbon sequestration opportunities through pilot projects, methodology development, reporting, and market validation. WESTCARB research will inform policymakers, communities, and businesses on how to invest in carbon capture and storage technology development and deployment to achieve climate change mitigation objectives.

The specific objectives of the Phase II Lake County fuel reduction pilots are to investigate the feasibility of fuels-treatment-based terrestrial sequestration by conducting pilot projects in a representative West Coast forest; compile information on site conditions, fuel treatment prescriptions, and costs; and inform and field- test the WESTCARB fire GHG emissions methodology. Fuels treatments were implemented on two project areas: Bull Stewardship and Collins-Hot Rocks.

Methodology for measuring impacts of hazardous fuels treatments

Pre- and post-treatment measurements were made on two fuels treatment projects in Lake County, Oregon. These projects involved removal of non-commercial biomass and sawtimber with the overall objective of reducing fuel loading and risk of catastrophic wildfire. The actual fuels treatments were not initiated under WESTCARB support, but they provided an opportunity to conduct on-the-ground measurements of actual hazardous fuel reduction efforts.

The fuel reduction activities were located in the southwest corner of the county. One project area, Bull Stewardship, was on the Fremont-Winema National Forest, and the other, Collins-Hot Rocks, was on privately owned land.

A total of 38 plots were established in the Bull Stewardship and 22 in the Collins Companies Hot Rocks lands. Pre- and post-treatment measurements on these plots addressed live trees greater than 5 cm diameter at breast, canopy density, standing dead wood, understory vegetation, forest floor litter and duff, and lying dead wood. These represent the forest carbon pools that are likely to be affected by fire, treatment, or both, and so are critical to the accounting of hazardous fuel reduction treatment impacts and potential wildfire impacts on forest carbon.

These measurements were used to determine the carbon stocks before and after treatment and before and after a potential wildfire, for each project area. Growth modeling was conducted with the Forest Vegetation Simulator for both with and without treatment stands. Emissions from a potential fire were modeled in both with- and without-fuels treatment scenarios using both the Fuel Characteristic Classification System and the Forest Vegetation Simulator fire and Fuels Extension (FVS-FFE). FVS was also used to project growth on burned stands, incorporating the impacts of fire on the future stand.

Because it was not possible to send harvested biomass that did not go into sawtimber to a biomass energy plant and it was instead piled for burning, the CO2, CH4, and NxO emissions from burning this biomass were calculated. Board feet of timber harvested was converted to metric tons of carbon, with retirement rates applied.

Project Outcomes

Bull Stewardship

Including carbon stored in long term wood products and emissions from pile burning, for treated stands without wildfire, a total of 73.2 tons of carbon per acre are stored, with 60.4 t C/ac still stored in the same stands following a wildfire.

Incorporating the risk of fire of 0.6% to calculate net emissions or removals (section 2.8), the fuels treatment on the Bull Stewardship project resulted in an effective immediate net emissions of 36.7 t CO2-e/ac (10.0 tons of carbon per acre).

In the absence of a wildfire, the fuels treatments and commercial harvest result in short term emissions of 59.4 t CO2/ac and emissions of 36.5 t CO 2/ac over 60 years (table A1).

Table E1: Net short and long term emissions from fuels treatment without fire on Bull Stewardship in tons of carbon dioxide per acre (+ = removals; - = emission)

	Short term 10 years	Long term 60 years
Harvested timber	17.2	12.6
Treatment emissions	-68.2	-40.7
Pile burning emissions (CO_2e)	-8.4	-8.4
NET	-59.4	-36.5

For the treatment to yield benefits to the atmosphere, the emissions from treatments will need to be offset by reductions in emissions from a potential wildfire hitting the area. In order for the treatment to have an impact, such a fire would have to occur before fuels have returned to hazardous conditions, at which point it will be necessary to re-treat the forest. According to the FVS-modeled results, if a wildfire were to occur in the year of treatment, after 10 years the net emissions from treatment would be 40.7 t CO_2/ac.

Collins-Hot Rocks

Including carbon stored in long term wood products and emissions from pile burning, for treated stands without wildfire, a total of 34.1 tons of carbon per acre are stored, with 25.1 t C/ac still stored in the same stands following a wildfire.

Incorporating the risk of fire of 0.6% to calculate net emissions or removals (section 2.8), the fuels treatment on the Collins-Hot Rocks project resulted in an effective immediate net carbon emission of

76.3 t CO_2-e/ac (20.8 tons of carbon per acre).

In the absence of a wildfire, the fuels treatments and commercial harvest result in short term emissions of 108 t CO_2/ac and emissions of 113 t CO_2/ac over 60 years (table A2).

Table E2: Net immediate and long term emissions from fuels treatment without fire on Collins-Hot Rocks in tons of carbon dioxide per acre (+ = removals; - = emission)

	Short term 10 years	Long term 60 years
Harvested timber	8.8	6.2
Treatment emissions	-101.9	-104.9
Pile burning emissions	-17.6	-17.6
(CO_2e)		
NET	-110.7	-116.3

For the treatment to yield benefits to the atmosphere, the emissions from treatments will need to be offset by reductions in emissions from a potential wildfire hitting the area. In order for the treatment to have an impact, such a fire would have to occur before fuels have returned to hazardous conditions, at which point it will be necessary to retreat the forest.
According to the FVS-modeled results, if a wildfire were to occur in the year of treatment, after 10 years the net emissions from treatment would be 81.1 t CO_2/ac.

Related Efforts

The Lakeview Stewardship Group developed the 2005 Long-Range Strategy for the Lakeview Federal Stewardship Unit (Lakeview Stewardship Group 2005; see http://www.lcri.org/unit/longrange.htm) and the revised 2010 Long-range Strategy for the Lakeview Federal Stewardship Unit. In conjunction with the WESTCARB research efforts, the work of the Lakeview Stewardship Group have recently borne fruit in six important developments.

- After lengthy negotiations, a 20-year Interagency Biomass Supply MOU was signed on November 1, 2007. The purpose of the MOU is to provide a framework for planning and implementing forest and rangeland restoration and fuels reduction projects that address identified resource needs while being supportive of the Lakeview Biomass Project.
- The efforts of Lake County Resources Initiative (LCRI) and its Lake County partners have resulted in a commitment to the first 10-year Stewardship Contract in the US Forest Service Pacific Northwest Region. The contract, considered a model for the region, provides long-term supply of material necessary for the recent investments in a biomass power plant and small-log mill described below.
- Oregon Governor Kulongoski's office and biomass plant developer DG Energy jointly announced in January 2007 that DG Energy will construct a 13 MW biomass plant in Lakeview. This represented the culmination of multi-year efforts by all the partners in the Lakeview Stewardship Group to reach agreement around sustainable harvest levels and long-term biomass supply mechanisms necessary for investment in new capacity. Since collecting all the data from the stewardship contracts and other significant

information from private lands it has been determined that a 25 MW biomass plant is sustainable. Currently the project is scheduled for a final decision on construction during summer 2010 and breaking ground in September 2010 with an estimated completion date of December 2012.

- Oregon Governor Kulongoski in March 2007 announced that the Collins Companies will expand their Fremont Sawmill operation in Lakeview by building a new $6.8 million dollar small-log mill. The small-log mill is the direct result of the 20-year Interagency Biomass Supply MOU and 10- year Stewardship Contract efforts spearheaded by LCRI, and provides an added tool for improving management of forests and hazardous fuels in Lake County.
- Considerable changes have occurred on Fremont-Winema National Forest since the beginning of the WESTCARB project in 2006. The original Forest Service prescriptions for Bull Stewardship, Burnt Willow and Kava are for much lighter treatments than treatments currently being implemented by the Forest Service. One of the critical outcomes is that there is infrastructure in place to restore the Forest Service lands to healthy conditions that will be able to better adapt to climate change.
- The national office of the Forest Service announced in February 2010 that they are accepting proposals for the Collaborative Forest Landscape Restoration Program (CFLRP). Region 6, which includes Lake County, sent in five proposals with the Lakeview Stewardship Group, with Fremont-Winema proposal being the number one priority. Over 10 years this could mean an additional 20 million dollars above regular appropriations for fuels management and restoration in the 500,000 acre Lakeview Federal Stewardship Unit.

Conclusions and Recommendations

In both projects, the treatments resulted in overall carbon emissions. This result clearly has negative implications for the future potential of fuels treatments as a carbon projects offset category. Within the treated areas, both projects had significant net emissions when considering treatment and the risk of a potential wildfire. If a fire were to occur in the year of treatment, all projects would still experience net emissions, though the impact of treatment emissions would be slightly reduced.

Both pilots led to a projected decrease in crown fire potential, which decreases fire severity and size. While treatments lead to net carbon emissions in both the short and long term in all projects, there are, of course, additional benefits to fuels treatments, such as increased ability to successfully fight fires and decreased cost of fire fighting; reduced loss of life and property; and reduced potential damage to wildlife habitat.

The results from this study in combination with the paired study in Shasta County and the allied study in Mendocino National Forest underlie the unsuitability of fuels treatment as a potential greenhouse gas offset generating activity. Instead we argue the shift should be made to policies minimizing greenhouse gas emissions from wildfires and from fuel treatments while minimizing wildfire risks to lives, homes, wildlife habitat, and livelihoods in the WESTCARB region.

CHAPTER 1: Introduction

1.1 Backround and overview

The West Coast Regional Carbon Sequestration Partnership (WESTCARB), led by the California Energy Commission, is one of seven US Department of Energy regional partnerships working to evaluate, validate and demonstrate ways to sequester carbon dioxide and reduce emissions of greenhouse gases linked to global warming. Terrestrial (forestry and land use) sequestration options being investigated include afforestation, improved management of hazardous fuels to reduce GHG emissions from wildfires, biomass energy, and forest management. Shasta County, California and Lake County, Oregon were chosen for Phase II terrestrial sequestration pilot projects because of the diversity of land cover types present, opportunities to implement the most attractive terrestrial carbon activities identified in Phase I, and replication potential elsewhere in the WESTCARB region.

Earlier reports identified fire as a significant source of GHG emissions throughout the WESTCARB region. Average estimated emissions from fires for the 1990-96 analysis period were: 1.03 $MMTCO_2e$ for Oregon (Pearson et al 2007a); 1.83 $MMTCO_2e$ per year for California (Pearson et al 2009); 0.18 $MMTCO_2e$/yr for Washington (Pearson et al. 2007b); and 0.47 $MMTCO_2e$/yr for Arizona (Pearson et al. 2007c).

The estimated baseline GHG emissions helped focus attention in Phase II on the questions: can actions by landowners to manage forest fuel loads be shown to produce measurable GHG reductions by decreasing the risk, severity, or extent of catastrophic wildfires? If so, can scientifically rigorous methods for measuring, monitoring, and verifying these GHG reductions serve as the basis for new protocols and market transactions, ultimately allowing landowners who reduce hazardous fuels to receive "carbon credit" revenues and improving the cost-effectiveness of fuel reduction? To explore these questions, hazardous fuel reduction (and where possible, removal of fuel for biomass energy generation) was chosen as a WESTCARB Phase II pilot activity in Shasta and Lake counties, and the WESTCARB Fire Panel was formed to develop fire GHG methodologies and protocols as needed.

1.2 Project Objective

The overall goal of WESTCARB Phase II is to validate and demonstrate the region's key carbon sequestration opportunities through pilot projects, methodology development, reporting, and market validation. WESTCARB research will inform policymakers, communities, and businesses on how to invest in carbon capture and storage technology development and deployment to achieve climate change mitigation objectives.

The specific objectives of the Phase II Lake County fuel reduction pilots are to:

- Verify the feasibility of fuels-treatment-based terrestrial sequestration by conducting pilot projects in a representative West Coast forest;

- Compile information on site conditions and fuel treatment prescriptions;
- Inform and field-test the WESTCARB fire GHG emissions methodology by:
  - o Collecting measurements of real-world fuel treatments to quantify:
    - The carbon stocks available to be burned before and after treatment,
    - The direct impacts of fuel treatments on carbon stocks in different carbon pools (e.g. increases in dead wood, decreases in dense growth), and
    - The fuel removed from the forest for potential biomass energy applications;
  - o Providing input data for fire models used to simulate fire behavior and emissions in the baseline (without-treatment) and with-treatment scenarios.
- Promote continued hazardous fuels reduction efforts on Lake County forests and support the location of a biomass power plant in Lakeview through the work of the Lake County Resources Initiative including:
  - o Serving as a liaison to the Lakeview Stewardship Group to assist in identifying the sustainable scale for the biomass power plant in Lakeview.
  - o Serving as a liaison to secure a Memoranda of Understanding with U.S. Forest Service, Bureau of Land Management, and Oregon Department of Forestry stating a commitment to supply the biomass power plant.

1.3 Report Organization

The report is organized in four sections: project approach, results, related work and conclusions/ recommendations. Section 2 summarizes the private- and federal-lands fuel treatments chosen for study as WESTCARB pilot activities, and methods used for pre- and post-treatment measurements and data analysis. Section 3 provides results of those measurements and analyses. Section 4 details related work undertaken by the Lake County Resources Initiative regarding continued hazardous fuels treatments in Lake County. Section 5 discusses the findings and provides recommendations based on this research.

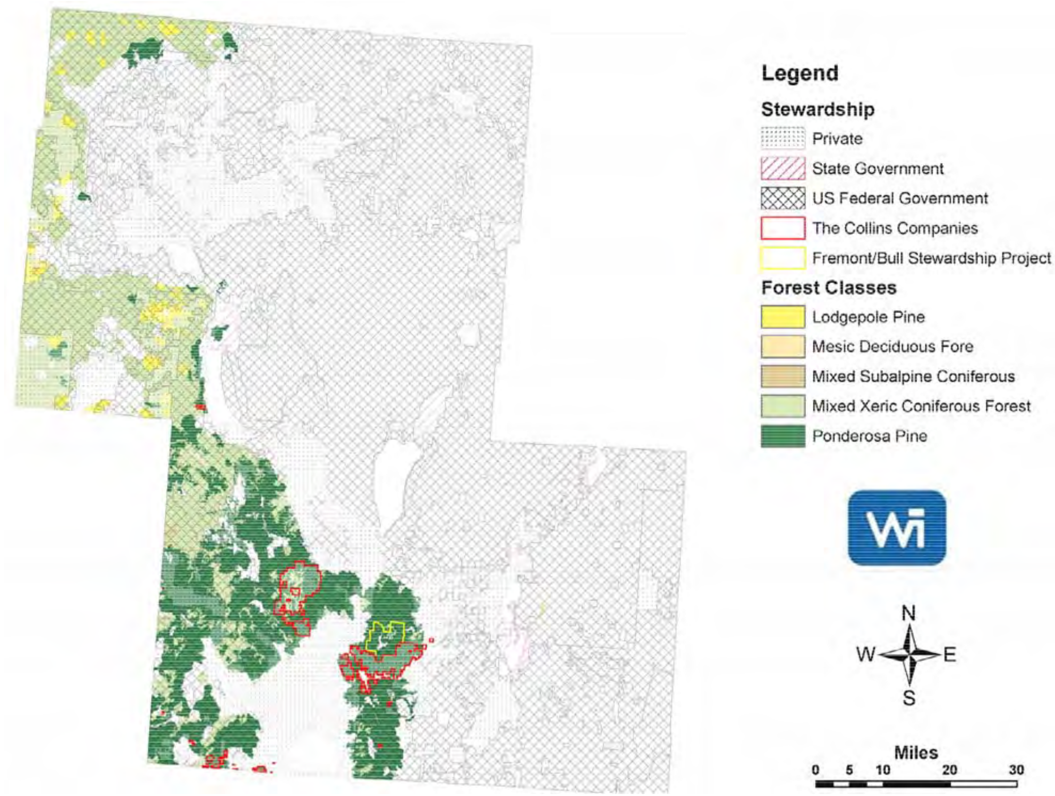
CHAPTER 2:
Project Approach

2.1 Fuel Reduction Project Locations and Description

Pre- and post-treatment measurements were made on two fuels treatment projects in Lake County, Oregon. These projects involved removal of non-commercial biomass and sawtimber with the overall objective of reducing fuel loading and risk of catastrophic wildfire. Treatments also included chipping and removal of biomass fuel to a biomass energy plant. The actual fuels treatments were not initiated under WESTCARB support, but they provided an opportunity to conduct on-the-ground measurements of actual hazardous fuel reduction efforts.

The fuel reduction projects were located in the North Warner Mountains, northeast of Lakeview, Oregon. Figure 1 shows Lake County land ownership and forest classes. The fuel reduction activities were located in the southwest corner of the county.

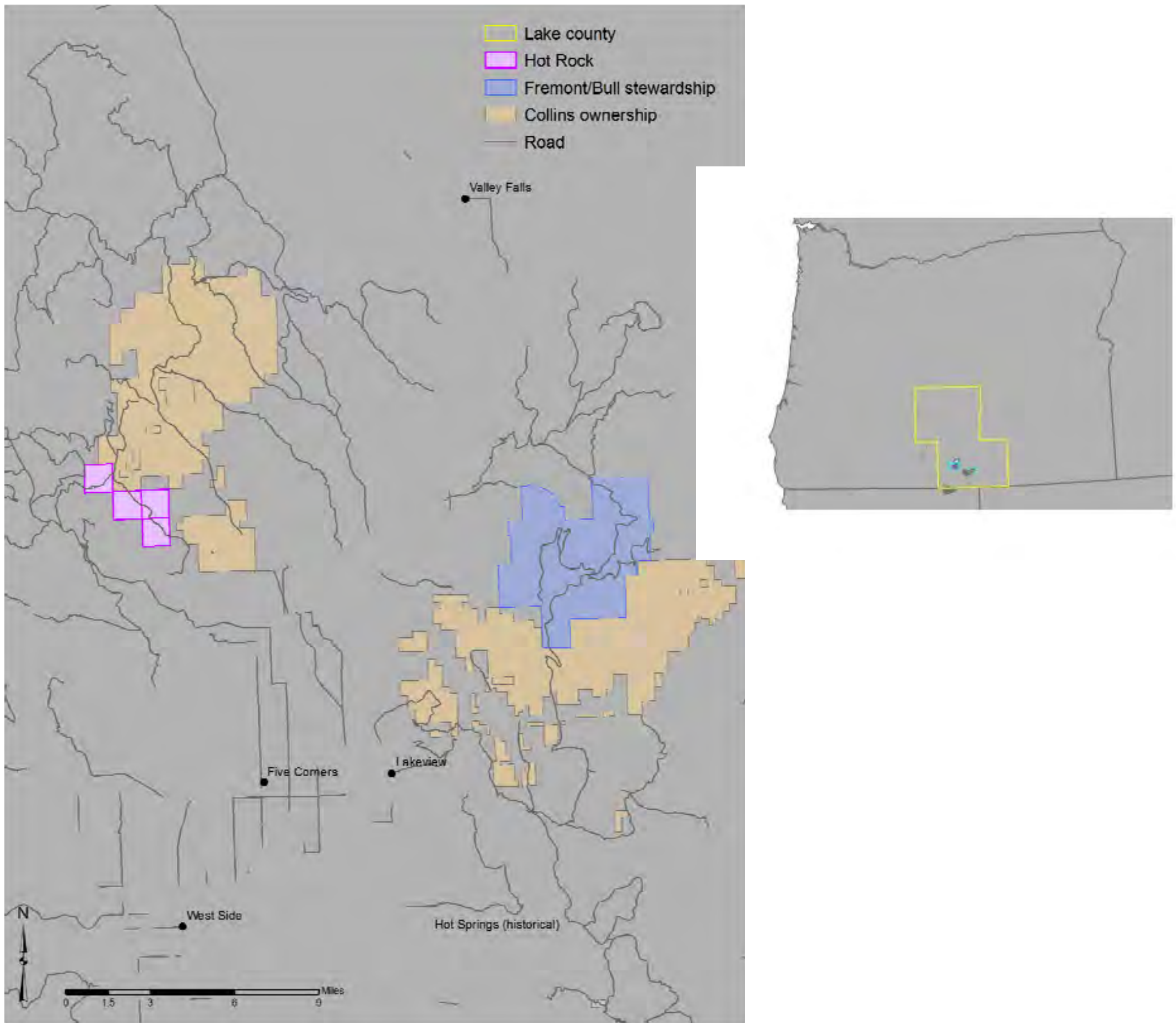
Figure 1: Lake County forest classes, Collins Companies lands (red) and Bull Stewardship Project boundary (yellow) adjacent to the eastern Collins Companies parcel.



The study on fuels treatments in Lake County was designed to examine the major ownership classes on forestlands in the county: Federal Government-owned National Forests and privately-owned industrial timberlands (Fig. 1 and 2):

Federal lands - Fremont-Winema National Forest
Private industrial timberlands – Collins Companies lands

Figure 2: Lake County - US Forest Service Bull Stewardship Project (blue), and Collins Company Hot Rocks fuel treatments (pink).



2.1.1 Fuel Reduction on Bull Stewardship Project Lands

Location

The Bull Stewardship Project, on US Forest Service Fremont-Winema National Forest lands, was implemented by Collins Companies. The project is located approximately 9 miles northeast of the town of Lakeview, Oregon within the boundary of the Lakeview Federal Sustained Yield Unit in the Crooked Creek and Deep Creek Watersheds. The treatment area was 1,200 acres.

Treatment

Fuel reduction treatments began in July 2006, with pre-treatment measurements by Winrock/LCRI crews immediately preceding treatment. Treatments on Bull Stewardship were suspended in 2006 and began again in 2007. The treatments were ultimately completed in 2008. Stoppages were due to excessive fire risks.

The overall objective of the Bull Stewardship Project is forest health improvement and wildfire risk reduction, accomplished through a combination of commercial timber harvest and non-commercial biomass removals. Two types of treatment unit are included: timber harvest/stewardship and stocking level control. The treatment units within Bull Stewardship are shown in Figure 3.

On the timber harvest/stewardship units, the prescription calls for removal of commercial timber >9" diameter at breast height (DBH) (timber harvest component) and removal of non-merchantable material 7-8.9" DBH (stewardship component). The contractor has the option to remove non-merchantable material, including slash from commercial timber and whole non-commercial (<9") trees, for chipping and transport to a cogeneration facility.

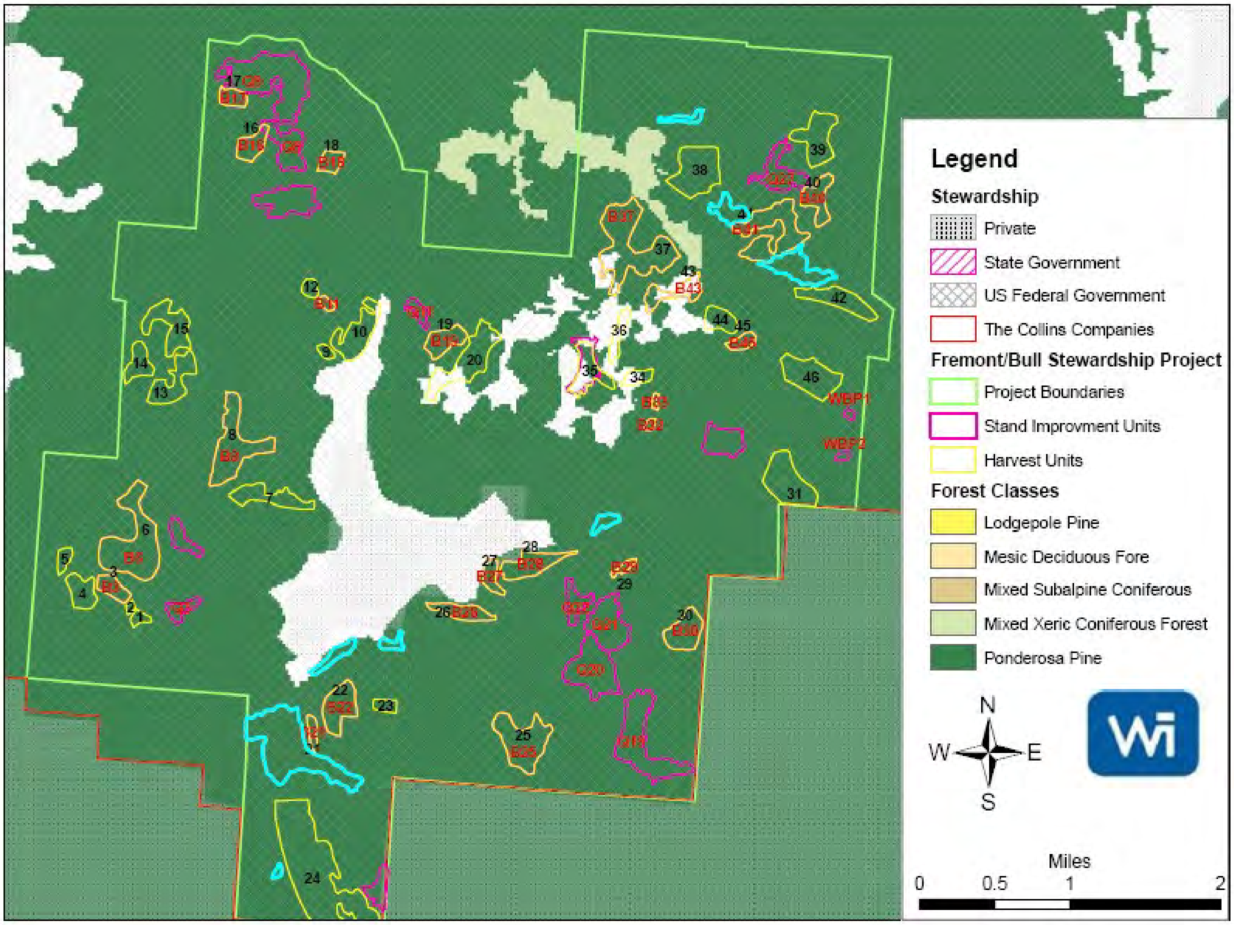
On the stocking level control units, several different prescriptions exist, all requiring treatment of material 2 ft tall through 8.9" DBH inclusive. This material remains where it is cut, to reduce fuel loading (fuel ladders), but is not removed to a landing for further processing, and there is no commercial (>9") timber removal on these units. The objective is to favor Western White Pine and Ponderosa Pine.

Specific prescriptions on the different stocking level control units include:

> Treatment 1: Cut all coniferous live trees that are 2 feet tall through 8.9" DBH inclusive. Inclusive trees shall be cut within two drip lines of all western white pine or ponderosa pine 18"DBH or greater.
>
> Treatment 2: Cut all coniferous live trees that are 2 feet tall through 8.9" DBH inclusive within two drip lines of all western white pine or ponderosa pine 11"DBH or greater.
>
> Treatment 3: Cut all coniferous live trees that are 2 feet tall through 8.9" DBH inclusive within two drip lines of all ponderosa pine 18"DBH or greater.
>
> Treatment 4: Cut all coniferous live trees that are 2 feet tall through 6.9"DBH inclusive. Inclusive trees and all white fir and lodgepole pine shall be cut within two drip lines of all western white pine or ponderosa pine 18"DBH or greater. Do not cut any western white pine or ponderosa pine within the two drip lines of another western white pine or ponderosa pine. Do not include white fir 18"DBH or greater in spacing calculations.

According to Forest Service records, 1.22 million cubic feet (1,002 cubic feet/acre) were harvested in the course of the treatment.

Figure 3: Treatment units on the Bull Stewardship Project



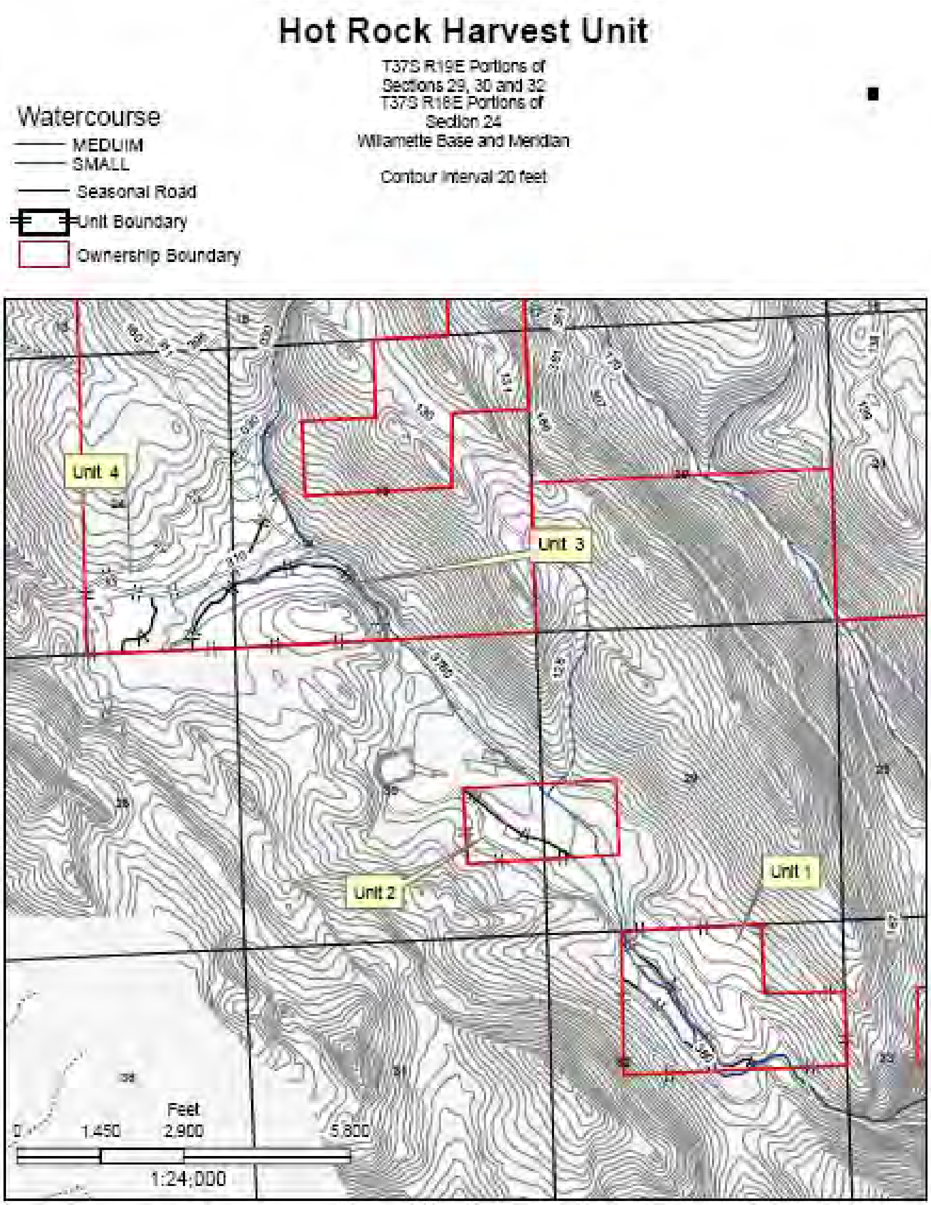
Treatments include commercial harvest units (yellow), stand improvement/stocking control units (pink), and combined timber harvest/stand improvement (blue).

2.1.2 Fuel Reduction on Collins Companies Lands

Location

Forest health/wildfire risk reduction projects on Collins Companies lands were included as WESTCARB pilots to evaluate approaches, costs and benefits of fuel reduction on private industrial timber lands. In 2007, Collins Companies began implementing fuels treatments on Collins lands in the Hot Rocks harvest units. See Figures 1 and 2 for overall Collins ownership boundaries in Lake County (red boundary), and Figure 4, showing the Hot Rocks harvest units. The total area treated was 288 acres.

Figure 4: Hot Rocks harvest units, Collins Companies lands.



Treatment

Treatments were begun in June 2008 and completed in October 2008. The objectives of the Collins-Hot Rocks project was forest health improvement and wildfire risk reduction, accomplished through a combination of commercial timber harvest and non-commercial biomass removals. Treatments included selection harvest, commercial thinning, and variable retention harvest.

Selection harvest entails cutting trees greater than 8" dbh, with a post-harvest target of $80ft^2$ basal area per acre and 160 trees per acre. Commercial thinning also targets a post-harvest basal area of $80ft^2/ac$, but the minimum cutting diameter is 3", and there are approximately 120 residual trees per acre. The variable retention post-harvest targets are 30 trees per acre and $20ft^2/acre$. In all three harvest systems, the focus is on choosing retention trees which are defect and disease free, possess phenotype superiority and a live crown ratio[1] greater than 50%. Some wildlife trees are also retained based on nesting potential.

The harvest removed 2,501 thousand board feet of sawtimber (8.7 thousand board feet /ac).

2.2 Pre- and Post-Treatment Measurement Methods

Field pre-treatment measurements[2] of Bull Stewardship and Collins-Hot Rocks fuels treatments were made in 2006 and 2007 and post-treatment measurement of both projects were made in 2008 and 2009.

2.2.1 Measurement Methods

The purpose of the measurements was to quantify the carbon stocks available to be burned before and after treatment, the direct impacts of fuel treatments on carbon stocks in different carbon pools (e.g. increases in dead wood, decreases in dense growth), and the fuel removed from the forest for biomass energy during treatment. Measurements also provided input data for fire models used to simulate fire behavior and emissions in the baseline (without-treatment) and with-treatment scenarios.

A total of 38 plots were established in the Bull Stewardship and 22 in the Collins Companies Hot Rocks lands.

Appropriate measurements of the following forest components were made at each plot:

- All trees >5 cm diameter at breast height, measured in nested plots and numbered for post- treatment measurements;
- Canopy density, measured at 36 points centered on the plot center;
- Standing dead wood;
- Understory vegetation, forest floor litter and duff, measured in clip plots and sub-sampled for dry weight determination;
- Lying dead wood, measured along transects, categorized by density class, and sub-sampled for density determination.

These represent the forest carbon pools that are likely to be affected by fire, treatment, or both, and so are critical to the accounting of hazardous fuel reduction treatment impacts and potential wildfire impacts on forest carbon. See Annex A for detailed Standard Operating

[1] The ratio of tree crown length to total tree length

[2] Field crews were made up of staff from Winrock and LCRI

Procedures followed in conducting pre- and post-treatment measurements of Lake County fuels treatments.

Plot locations were pre-assigned and random within units, taking into consideration elevation and species differences between units (higher elevation White Fir, higher elevation Lodgepole Pine, lower elevation White Fir/Ponderosa Pine). On navigation to each pre-assigned plot location, GPS coordinates were recorded and the plot center was marked using brightly painted rebar for ease of relocation post- treatment. Slope was noted for later analysis (plot-to-hectare expansion factor). All trees >5cm DBH were measured in a nested circular plot design, and numbered for post-treatment tally. Forest floor litter and duff was sampled in two 30 cm x 30 cm quadrats per measurement plot, and sub-samples collected for dry weight determination in a laboratory. The diameter of lying dead wood was measured along two 50 m line transects, categorized by density class, and sub-samples collected for density determination (dry weight per unit of green volume) and sent to a laboratory for drying. Post-treatment measurements were similar to pre-treatment as the objective is to examine the impact of treatments on forest carbon stocks. Trees were measured pre-treatment, and thus were only tallied to record removed/remaining post treatment. Forest floor litter and duff was re-measured in quadrats, and lying deadwood re-measured in line transects.

2.3 Fire Modeling Methods

Based on the field data disaggregated by carbon pool, emissions from a potential fire were modeled in both with- and without-fuels treatment scenarios. The modeling was conducted using two different approaches.

1. The FCCS program (Fuel Characteristic Classification System) was developed by the Pacific Northwest Research Station to capture the structural complexity and geographical diversity of fuel components across landscapes and to provide the ability to assess elements of human and natural change. FCCS is a software program that allows users to access a nation-wide library of fuelbeds or create customized fuelbeds. The fuelbeds are organized into six strata: canopy (trees), shrubs, nonwoody vegetation, woody fuels (lying deadwood and stumps), litter-lichen-moss, and ground fuels (duff and basal accumulations). FCCS calculates the relative fire hazard of each fuelbed, including crown fire, surface fire behavior, and available fuel potentials. It also reports carbon storage by fuelbed category and predicts the amount of combustible carbon in each category.[3]

2. In addition to the FCCS modeling, fire effects were modeling using the Forest Vegetation Simulator Fire and Fuels Extension (FVS-FFE). FVS provides different outputs to FCCS and FVS can be used to project growth, incorporating the impacts of fire on the future stand.

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[3] More information is available at the FCCS website: http://www.fs.fed.us/pnw/fera/fccs/. The modeling was conducted by Dr. David "Sam" Sandberg – Emeritus of the PNW Research Station Fire and Environmental Application Team.

The two models produced slightly different results, as they use different modeling methodologies and different biomass equations. They also produce somewhat different output. Reported outputs from FCCS include flame length in feet; crown fire potential as a scaled index from 0-9; rate of spread in feet per minute; and carbon consumed for live canopy, dead wood, and total. Reported results from FVS-FFE include flame length in feet; the crowning index in miles/hour; and total carbon consumed. Results for both prescribed fire and wildfire are reported from FCCS, while only wildfire is reported from the FVS- FFE results.

Although FVS uses a somewhat simpler methodology than FCCS for projecting fire impacts, it is based on established fire models and allows for growth projections. In order to address growth over time, FVS projections are used throughout the results, but FCCS output is presented to demonstrate the range of potential fire emissions.

2.4 Fire Risk

Annual burn probability is difficult to project accurately as it is a factor of the likelihood of ignition and the conditions on the ground at the time of ignition, including fuels, climate, temperature, and topography (see Finney, 2005). WESTCARB research conducted by the Oregon Department of Forestry and the USDA Forest Service shows that the average overall conditional burn probability (probability that wildfire reaches a stand given one ignition source) in southeastern Oregon is 2.2% for untreated landscapes and 1.7% for the treated landscape, a 22.6% reduction in burn probability as a result of treatment (Jim Cathcart, 2010, Oregon Department of Forestry, pers. comm.). This is an overestimate of annual burn probability as it does not include the probability of an ignition. The mean fire return interval from 2001 to 2008 for dry-mesic mixed conifer forests in Lake County is 153 years (Eric Waller, 2010, UCB CFRO, pers. comm.). The inverse of this provides an annual burn probability of 0.6%. It is important to note that this is a generalized probability and is not based specifically on pre- and post-treatment conditions for these projects, but rather for Lake County as a whole.

2.5 Growth Modeling

Stand growth, both with- and without-treatment and considering all pools, was modeled with the US Forest Service's Forest Vegetation Simulator (FVS), using the Inland California and Southern Cascades variant. The standard allometric equations in the Fire and Fuels Extension (FFE) of FVS were used to produce biomass and carbon reports in conjunction with forest growth. Data from both the pre- and post-treatment inventories were used, with the pre-treatment inventory year counted as year zero to compare with and without treatment scenarios. Growth was projected over a 60 year period, and did not include any additional future treatments. To incorporate the effects of wildfire on growth, FVS-FFE was also used to model wildfire behavior.

2.6 Modeled Scenarios

For both fire and growth, four different scenarios were modeled for both projects. Each scenario includes the following carbon pools: above-ground live, below-ground live, standing dead, and lying dead. For the treated scenarios, carbon stored in merchantable timber after 100 years is included. To simplify calculations, the emissions arising from wood product conversion and subsequent retirement are included at the beginning of the project.

	Untreated	**Treated**
No Wildfire	1.Untreated, no fire	3.Treated, no fire
Wildfire	2.Untreated, wildfire	4.Treated, wildfire

Scenario 1 gives the situation where there is no treatment or fire. At time zero it represents simply the carbon stocks (tons of carbon per acre) prior to treatment.
Scenario 2 is the carbon emissions and remaining stocks following a wildfire on untreated lands.
Scenario 3 is the carbon stocks remaining after the treatment, incorporating any emissions that were a result of treatment activities but in the absence of any fire.
Scenario 4 is the carbon emissions and remaining stocks following a wildfire on treated lands.

2.7 Harvested Timber and Biomass

Timber harvested is converted to metric tons of carbon according to Smith et al. (2006) that provides a factor of 7.48 thousand cubic feet and 0.44 thousand board feet per metric ton of carbon. The fraction of carbon in primary wood products remaining over time in end uses and stored in land fill, as described in Smith et al. (2006), are then applied: after 10 years, 48.9% of carbon will remain in use as long-term wood products, and 12.5% will be sequestered in landfills; after 60 years, 20% of carbon will remain in long-term wood products, and 25.1% in landfills; after 100 years, 13% will remain in wood products and 27.9% in landfills.

While the intention for this project was to use harvested biomass for energy production, there have been setbacks in the development of a biomass energy plant in the area and thus no demand for such a product(see section 4.2). As a result, the harvested biomass has been piled and burned or piled awaiting the completion of a biomass power plant. For this reason, all harvested biomass that did not go into sawtimber is considered an emission as it will most likely be burned prior to completion of the plant.

There are many forested areas in need of hazardous fuels reduction without access to a biomass facility, and so this method of accounting, while it leads to increased emissions, will be broadly applicable.

The burning of these piles leads to emissions of methane and nitrous oxide as well as carbon dioxide. The following emissions factors are recommended by the US EPA (Battye and Battye 2002):

Assuming a smoldering fire: CH_4[4]: 0.21 t CO_2-e/t burned

NO_x[5]: 0.34 t Co_2-e/t burned

2.8 Net Impact Calculations

Where

- Ct carbon stocks remaining in the forest after treatment and without a wildfire
- Cw carbon stored as wood products
- Ce reduced emissions from using biomass for energy generation
- Cb carbon stocks in the forest before treatment and without a wildfire
- risk probability of fire
- Ctf carbon stocks remaining in the forest after treatment and with a wildfire
- Cbf carbon stocks remaining in the forest before treatment and with a wildfire

The net emissions or removals in year one are calculated as

$$\left[(Ct + Cw + Ce - Cb) * (1 - risk)\right] + \left[(Ctf + Cw + Ce - Cbf) * (risk)\right]$$

Where

Ct carbon stocks remaining in the forest after treatment and without a wildfire

Cw carbon stored as wood products

Ce reduced emissions from using biomass for energy generation

Cb carbon stocks in the forest before treatment and without a wildfire

risk probability of fire

Ctf carbon stocks remaining in the forest after treatment and with a wildfire

Cbf carbon stocks remaining in the forest before treatment and with a wildfire

This equation states that the net emissions in year 1 are equal to:

The high probability that there will be no fire multiplied by the difference between stored carbon before and after treatment

[4] Global warming potential of 21 used

[5] Global warming potential of 310 used

Plus

The low probability that there <u>will be a fire</u> multiplied by the difference in total carbon storage after a fire in the treated stand and in the baseline stand.

CHAPTER 3: Project Outcomes

3.1 Bull Stewardship

3.1.1 Field Results

Prior to treatment, the Bull Stewardship project had 81.6 tons of carbon per acre across all pools. Following the treatment, the average carbon stock was 66.3 t C/ac. Treatment therefore resulted in a decrease in carbon stocks of 15.3 tons per acre, 19% of pretreatment stocks. The breakdown by pool is shown in Table 2, and the confidence limits at a 90% confidence interval for the aboveground live carbon pool are shown in Table 2a.

Table 1: Bull Stewardship carbon stocks (metric t C/ac) before and after fuels treatments

Carbon pool	Pre-treatment	Post-treatment	Difference
Trees	48.2	35.0	-13.2
Roots	13.8	9.7	-4.1
TOTAL TREES	62.0	44.7	-17.3
Standing dead	1.2	0.8	-0.4
Down dead wood	14.4	10.5	-3.9
TOTAL DEAD WOOD	15.6	11.3	-3.7
Forest Floor	3.6	9.8	6.2
Shrubs/herbaceous	0.5	0.6	0.1
TOTAL	81.6	66.3	-15.3

Table 1a: Upper and lower confidence limits at 90% CI for Bull Stewardship aboveground live carbon stocks (metric t C/ac) before and after fuels treatments

Aboveground live carbon	Pre-treatment	Post-treatment
LCL	43.5	30.3
Mean	48.2	35.0
UCL	52.9	39.7
CL as a % of mean	9.7%	13.3%

3.1.2 Potential Fire Emissions

Using FCCS-created fuel beds, a wildfire in the untreated stands would yield 52.8 tons of CO2 per acre of emissions, while a wildfire in the treated stands would yield 42.0 t CO2/ac (Table 3). Using the FVS Fire and Fuels Extension, a wildfire in the untreated stands would yield 42.7 t CO2/ac of emissions, while a wildfire in the treated stands would yield 47.1 t CO2/ac (table 4).

The potential flame length and rate of spread are essentially the same following the treatment as they are before treatment. The crown fire potential is lower in the treated stands.

Table 2: FCCS fire modeling results for Bull Stewardship

	Prescribed Fire		Wildfire	
	Pre treatment	**Post-treatment**	**Pre-treatment**	**Post-treatment**
Flame Length (ft)	3.2	3.2	7.6	7.5
Crown Fire Potential (scaled index 0-9)	3.9	3.8	4.7	3.5
Rate of Spread (ft/min)	5.7	6.0	27.5	29.5
CO_2 emissions (t/ac)				
Canopy	-4.4	-5.1	-13.8	-15.4
Dead Wood	-28.2	-18.3	-36.3	-24.0
Litter	-2.4	-2.6	-2.8	-3.1
Total	-35.0	-26.0	-52.9	-42.5

Table 3: FVS fire modeling results for Bull Stewardship

	Wildfire	
	Pre-treatment	**Post-treatment**
Flame Length (ft)	6.6	6.7
Crowning index (miles/hr)[6]	14.5	24.7
CO_2 emissions (t/ac)	-42.7	-47.1
Total stand carbon remaining	69.5	53.5

3.1.3 Timber and Biomass

The harvest on Bull Stewardship yielded 1,020 ft^3/ac. According to the conversion factor in Smith *et al.* (2006), this equals 7.6 t C/ac. Based on carbon disposition rates, a total of 4.7 t C/ac will remain stored in either long-term wood products or landfill after 10 years; 3.4 t C/ac will remain stored in either long- term wood products or landfill after 60 years; and 3.1 t C/ac will remain stored in either long-term wood products or landfill after 100 years.

Subtracting the removed sawtimber (7.6 t C/ac) from the total carbon removed in treatment (15.3 t C/ac), the remaining piled biomass represents 7.7 t C/ac or 15.4 tons of biomass per acre. This yields the following emissions (as described in section 2.7):

CH_4: 15.4 t burned * 0.21 t CO_2-e/t burned = 3.2 t

CO_2e/ac NO_x: 15.4 t burned * 0.34 t Co_2-e/t burned

= 5.2 t CO_2e/ac.

The total CH_4 and NO_x emissions from pile burning are 8.4 t CO_2e/ac.

3.1.4 Growth Modeling

Based on FVS modeling (Table 4), in the absence of fire, the treatment resulted in an initial decrease in carbon stocks of 15.3 t C/ac (compare columns 1 and 2), but the treated stands had slightly higher growth than untreated stands (4.2 t C/ac), for a total decrease in live stocks of 11.1 t C/ac over a 60 year period relative to no treatment.

In the event of a wildfire in year zero, the treated stands contain 16.2 t C/ac less than the untreated stands (difference between columns 3 and 4 in Table 4). Over 60 years, carbon stocks in both treated and untreated stands decreased, but the decrease was somewhat less for treated

[6] The 20-foot windspeed required to cause an active crown fire.

stands. There was a total decrease in live stocks for treated stands of 6.8 t C/ac relative to untreated stands after 60 years.

Table 4: Modeled total stand carbon pre and post treatment and with and without fire on the Bull Stewardship project

Year	Untreated, no fire (1)	Treated, no fire (2)	Untreated, wildfire (3)	Treated, wildfire (4)
0	81.6	66.3	69.7	53.5
10	84.9	66.3	60.0	46.5
20	86.1	68.7	52.2	41.6
30	86.6	70.5	47.5	38.4
40	86.6	72.6	44.5	36.4
50	86.5	74.3	42.3	35.1
60	86.5	75.4	40.9	34.1
Total change	4.9	9.1	-28.8	-19.4
Total % change	106%	114%	59%	64%

Modeling conducted using the Fuels and Fire Extension of FVS. Data in metric tons of carbon per acre

FVS growth modeling (Table 6) indicates that after 60 years in the absence of wildfire, treated stands continue to have fewer trees per acre, a lower basal area, lower quadratic mean diameter[7] (QMD), and fewer cubic feet and board feet than untreated stands. However treated stands with wildfire have proportionally more and larger trees, higher basal area, and more merchantable timber than the original stand after 60 yr.

[7] The diameter corresponding to the mean basal area of a stand.

Table 5: Projected Growth on Bull Stewardship project, modeled in FVS

	Untreated			Treated		
	Year 0	Year 60 – no fire	Year 60 – wildfire	0	Year 60 – no fire	Year 60 - wildfire
Trees per acre	271	90	31	145	87	23
Basal area	214	200	63	143	176	53
QMD	12.1	20.2	19.3	13.4	19.3	20.6
Cubic feet	5,915	6,106	1,833	4,304	5,415	1,595
Board feet	28,406	31,462	8,861	22,116	28,047	8,284

However, the rate of change (Table 7) is greater in the treated stands for all measurements except QMD. This indicates that while the treated stands did not catch up to the untreated stands in absolute numbers, they had a lower mortality rate and a higher per tree growth rate overall. In addition, the trees remaining in the treated stands remained larger, on average, than those in the untreated stands.

In the event of a wildfire, treated stands have fewer trees per acre, and lower basal area, cubic feet and board feet after 60 years, but they have a higher rate of change in all categories except QMD than do untreated stands.

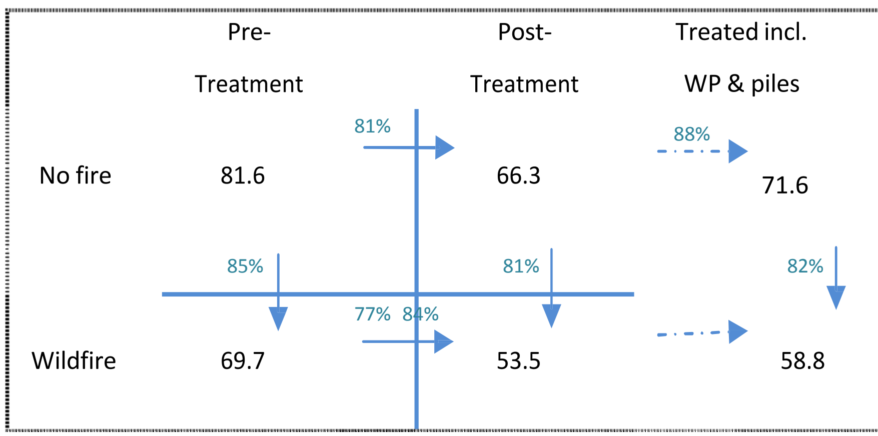
Table 6: Percent change after 60 years of growth on Bull Stewardship project

	Untreated		Treated	
	No fire	Wildfire	No fire	Wildfire
Trees per acre	33%	11%	60%	16%
Basal area	93%	29%	123%	37%
QMD	167%	160%	144%	154%
Cubic feet	104%	31%	126%	37%
Board feet	111%	31%	127%	37%

3.1.5 Net GHG Emissions/Sequestration

Including carbon stored in long term wood products and emissions from pile burning, for treated stands without wildfire, a total of 71.6 tons of carbon per acre are sequestered with 58.8 t C/ac still sequestered in the same stands following a wildfire. Figure 5 shows the tons of carbon per acre sequestered on Bull Stewardship in each of the four scenarios, the total carbon stored following treatment when wood products and biomass energy are included, and the percent change from untreated to treated and unburned to burned lands.

Figure 5: Tons of carbon per acre stored on Bull Stewardship project lands in each scenario, and including carbon stored in wood products and emissions from pile burning.



Percentages show change from untreated lands to treated or from unburned to burned. WP = storage in long term wood products

Incorporating the risk of fire of 0.6%, and utilizing the equation described above for net emissions or sequestration (section 2.8), [(Ct+Cw +Ce-Cb)*(1-risk)]+[(Ctf+Cw+Ce-Cbf)*(risk)], the fuels treatment on the Bull Stewardship project resulted in an effective immediate net emissions of 36.7 t CO2-e/ac (10.0 tons of carbon per acre).

In the absence of a wildfire, the fuels treatments and commercial harvest result in short term emissions of 59.4 t CO2/ac and emissions of 36.5 t CO 2/ac over 60 years (table 8).

Table 7: Net short and long term emissions from fuels treatment, without fire, on Bull Stewardship in tons of carbon dioxide per acre (+ = removals; - = emission)

	Short term 10 years	Long term 60 years
Harvested timber	17.2	12.6
Treatment emissions	-68.2	-40.7
Pile burning emissions (CO_2e)	-8.4	-8.4
NET	-59.4	-36.5

For the treatment to yield benefits to the atmosphere, the emissions from treatments will need to be offset by reductions in emissions from a potential wildfire hitting the area. In order for the treatment to have an impact, such a fire would have to occur before fuels have returned to hazardous conditions, at which point it will be necessary to re-treat the forest. According to the FVS-modeled results, if a wildfire were to occur in the year of treatment, after 10 years the net emissions from treatment would be 40.7 t CO2/ac. Therefore, the treatment leads to net emissions with or without fire, but total emissions are somewhat lower in the event of a wildfire.

3.2 Collins–Hot Rocks

3.2.1 Field Results

Prior to treatment, the Collins-Hot Rocks project had 54.9 tons of carbon per acre across all pools. Following the treatment, the average carbon stock was 35.0 t C/ac. Treatment therefore resulted in a decrease in carbon stocks of 19.9 tons per acre, 36% of pretreatment stocks. The breakdown by pool is shown in Table 8 and the confidence limits at a 90% confidence interval for the aboveground live carbon pool are shown in Table 8a.

Table 8: Collins-Hot Rocks carbon stocks (metric t C/ac) before and after fuels treatments

Carbon pool	Pre-treatment	Post-treatment	Difference
Trees	35.4	13.9	-21.5
Roots	9.8	4.0	-5.8
TOTAL TREES	45.2	17.9	-27.3
Standing dead	1.1	0.5	-0.6
Down dead wood	3.2	12.1	8.9
TOTAL DEAD WOOD	4.3	12.6	8.3
Forest Floor	4.9	4.1	0.5
Shrubs/herbaceous	0.5	0.5	0.0
TOTAL	54.9	35.0	-19.9

Table 8a: Upper and lower confidence limits at 90% CI for Collins-Hot Rocks aboveground live carbon stocks (metric t C/ac) before and after fuels treatments

Aboveground live carbon	Pre-treatment	Post-Treatment
LCL	27.4	10.9
Mean	35.4	13.9
UCL	43.4	17.0
CI as a % of mean	22.6	22.1

3.2.2 Potential Fire Emissions

Using FCCS-created fuel beds, a wildfire in the untreated stands would yield 26.8 tons of CO2 per acre of emissions, while a wildfire in the treated stands would yield 48.6 t CO2/ac (Table 9). Using the FVS Fire and Fuels Extension, a wildfire in the untreated stands would yield 28.6 t CO2/ac of emissions, while a wildfire in the treated stands would yield 33.1 t CO2/ac (Table 10).

The potential flame length and rate of spread are substantially greater following the treatment that it is before treatment. The crown fire potential however is lower in the treated stands. This may indicate that the treatment increased deadwood, leading to a low and fast-moving fire, but reduced the potential for the fire to reach the crown.

Table 9: FCCS fire modeling results for Collins-Hot Rocks

	Prescribed Fire		Wildfire	
	Pre-treatment	**Post-treatment**	**Pre-treatment**	**Post-treatment**
Flame length (ft)	2.0	3.6	4.5	8.5
Crown Fire Potential (scaled index 0-9)	3.3	2.1	4.0	3.2
Rate of Spread (ft/min)	3.1	4.8	13.3	24.0
CO_2 emissions (t/ac)				
Canopy	3.5	-2.6	-10.8	-7.7
Dead Wood	-10.5	-30.4	-13.0	-38.5
Litter	-2.4	-1.3	-2.8	-1.7
Total	-16.4	-34.3	-26.6	-47.9

Table 10: FVS fire modeling results for Collins-Hot Rocks

	Wildfire	
	Pre-treatment	Post-treatment
Flame Length (ft)	3.8	8.2
Crowning index (miles/hr)[8]	11.6	20.6
CO_2 emissions (t/ac)	-28.6	-33.1
Total stand carbon remaining	46.7	26.0

3.2.3 Timber and Biomass

The harvest on Hot Rocks yielded 8.7 mbf/ac[9]. According to the conversion factor in Smith et al. (2006), this equals 3.9 t C/ac. Based on carbon disposition rates, a total of 2.4 t C/ac will remain stored in either long-term wood products or landfill after 10 years; 1.7 t C/ac will remain stored in either long-term wood products or landfill after 60 years; and 1.6 t C/ac will remain stored in either long-term wood products or landfill after 100 years.

Subtracting the removed sawtimber (3.9 t C/ac) from the total carbon removed in treatment (19.9 t C/ac), the remaining piled biomass represents 16.0 t C/ac or 32.0 tons of biomass per acre. This yields the following emissions (as described in section 2.7):

CH4: 32.0 t burned * 0.21 t CO2-e/t burned = 6.7 t CO2e/ac

NOx: 32.0 t burned * 0.34 t Co2-e/t burned = 10.9 t CO2e/ac.

The total CH4 and NOx emissions from pile burning are 17.6 t CO2e/ac.

3.2.4 Growth Modeling

Based on FVS modeling (Table 11), in the absence of fire, the treatment resulted in an initial decrease in carbon stocks of 19.9 t C/ac (compare columns 1 and 2), and a reduced increase in carbon stocks of 8.7 t C/ac after 60 years, for a total decrease in live stocks of 28.6 t C/ac over a 60 year period relative to no treatment.

In the event of a wildfire in year zero, the treated stands contain 20.7 t C/ac less than the untreated stands (difference between columns 3 and 4). Over 60 years, carbon stocks in both treated and untreated stands decreased, but the decrease was slightly less for treated stands.

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[8] The 20-foot windspeed required to cause an active crown fire.

[9] Harvest data was reported in cubic feet by the Forest Service for the Bull Stewardship project and in board feet by the Collins Company for the Hot Rocks project.

There was a total decrease in live stocks for treated stands of 17.9 t C/ac relative to untreated stands after 60 years.

Table 11: Modeled total stand carbon pre and post treatment and with and without fire on the Collins-Hot Rocks project

Year	Untreated, no fire (1)	Treated, no fire (2)	Untreated, wildfire (3)	Treated, wildfire (4)
0	54.9	35.0	46.7	26.0
10	61.7	33.9	39.9	20.9
20	69.0	37.3	36.0	18.6
30	73.4	41.3	34.6	17.8
40	76.8	45.6	34.6	17.8
50	79.5	49.5	35.6	18.4
60	81.8	53.2	37.1	19.2
Total change	26.9	18.2	-9.6	-6.8
Total % change	149%	152%	79%	74%

Modeling used the Fuels and Fire Extension of FVS. Results in metric tons of carbon per acre

FVS growth modeling (Table 13) indicates that after 60 years in the absence of wildfire, treated stands continue to have fewer trees per acre, lower basal area, and fewer cubic feet and board feet than untreated stands while the QMD is greater in the treated stands

Table 12: Projected Growth on Collins-Hot Rocks project, modeled in FVS

	Untreated			Treated		
	Year 0	**Year 60 – no fire**	**Yaer 60 – wildfire**	**0**	**Year 60 – no fire**	**Year 60 - wildfire**
Trees per acre	480	156	70	159	119	30
Basal area	198	210	87	77	158	43
QMD	8.7	15.7	15.1	9.4	15.6	16.2
Cubic feet	4,215	6,149	2,349	1,567	4,341	1,139
Board feet	13,887	28,639	10,139	5,168	19,151	5,135

However, the rate of change (Table 14) is greater in the treated stands for all measurements except QMD. This indicates that while the treated stands did not catch up to the untreated stands in absolute numbers, they had a lower mortality rate and a higher per tree growth rate overall. In addition, the trees remaining in the treated stands remained larger, on average, than those in the untreated stands.

Table 13: Percent change after 60 years of growth on Collins-Hot Rocks project

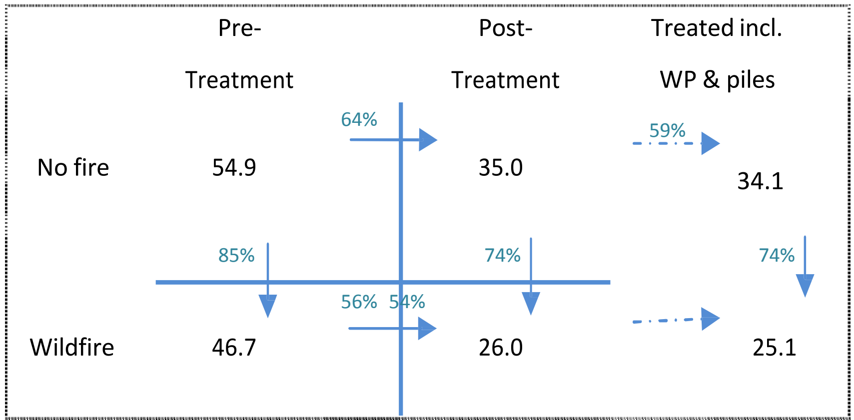
	Untreated		Treated	
	No fire	**Wildfire**	**No fire**	**Wildfire**
Trees per acre	33%	15%	75%	19%
Basal area	106%	44%	205%	56%
QMD	180%	174%	166%	172%
Cubic feet	146%	56%	277%	73%
Board feet	206%	73%	371%	99%

In the event of a wildfire, treated stands have fewer trees per acre, and lower basal area, cubic feet and board feet after 60 years, but they have a higher rate of change in all categories except QMD than do untreated stands

3.2.5 Net GHG Emissions/Sequestration

Including carbon stored in long term wood products and emissions from pile burning, for treated stands without wildfire, a total of 34.1 tons of carbon per acre are sequestered with 25.1 t C/ac still sequestered in the same stands following a wildfire. Figure 6 shows the tons of carbon per acre sequestered on Bull Stewardship in each of the four scenarios, the total carbon stored following treatment when wood products and biomass energy are included, and the percent change from untreated to treated and unburned to burned lands.

Figure 6: Tons of carbon per acre stored on Collins-Hot Rocks lands in each scenario, and including carbon stored in wood products and emissions from pile burning.



Percentages show change from untreated lands to treated or from unburned to burned. WP = storage in long term wood products

Incorporating the risk of fire of 0.6%, and utilizing the equation described above for net emissions or sequestration (section 2.8), [(Ct+Cw +Ce-Cb)*(1-risk)]+[(Ctf+Cw+Ce-Cbf)*(risk)], the fuels treatment on the Collins-Hot Rocks project resulted in an effective immediate net carbon emission of 76.3 t CO2-e/ac (20.8 tons of carbon per acre).

In the absence of a wildfire, the fuels treatments and commercial harvest result in short term emissions of 111 t CO2/ac and emissions of 116 t CO 2/ac over 60 years (table 15).

Table 14: Net short and long term emissions from fuels treatment without fire on Collins-Hot Rocks in tons of carbon dioxide per acre (+ = removals; - = emission)

	Short term 10 years	**Long term 60 years**
Harvested timber	8.8	6.2
Treatment emissions	-101.9	-104.9
Pile burning emissions (CO_2e)	-17.6	-17.6
NET	-110.7	-116.3

For the treatment to yield benefits to the atmosphere, the emissions from treatments will need to be offset by reductions in emissions from a potential wildfire hitting the area. In order for the treatment to have an impact, such a fire would have to occur before fuels have returned to hazardous conditions, at which point it will be necessary to retreat the forest. According to the FVS-modeled results, if a wildfire were to occur in the year of treatment, after 10 years the net emissions from treatment would be 81.1 t CO2/ac. Therefore, the treatment leads to net emissions with or without fire, but total emissions are lower in the event of a wildfire.

CHAPTER 4: Related Efforts

4.1 Lakeview Stewardship Group

The Lakeview Stewardship Group was formed in 1998-99, involving LCRI, the Collins Companies, Concerned Friends of the Fremont/Winema, Defenders of Wildlife, USDA Forest Service Fremont- Winema National Forest, Lake County Chamber of Commerce, Lakeview High School, Lakeview Ranger District, Oregon Department of Economic and Community Development, Paisley Ranger District, Sustainable Northwest, The Threshold Foundation, The Wilderness Society, and local citizens. These partners have been engaged in a long-term, consensus-based effort to articulate a strategy for sustainable forest management of the 495,000-acre Lakeview Federal Stewardship Unit (LFSU) in the Fremont-Winema National Forest. In the context of dramatically reduced timber harvest offerings, mill closures, economic decline and sometimes acrimonious industry vs. environment debates, the LSG has been working to develop collaborative management goals balancing the full range of economic, social and ecosystem values provided by the forest. A key output of this process was the 2005 Long-Range Strategy for the Lakeview Federal Stewardship Unit (Lakeview Stewardship Group 2005; see http://www.lcri.org/unit/longrange.htm) and the revised 2010 Long-range Strategy for the Lakeview Federal Stewardship Unit (see Annex B).

The LFSU long-term objectives are to "sustain and restore a healthy, diverse, and resilient forest ecosystem that can accommodate human and natural disturbances; sustain and restore the land's capacity to absorb, store, and distribute quality water; and provide opportunities for people to realize their material, spiritual, and recreational values and relationships with the forest." Integral to sustaining and restoring a healthy, diverse, and resilient forest ecosystem that can accommodate human and natural disturbances is the effort to improve management of wildfire on National Forest lands. Partners have focused on reaching agreement and developing new tools to reduce hazardous fuel loading and improve forest health. In relation to WESTCARB goals, the most important of these tools are: stewardship contracts, Memoranda of Understanding and other mechanisms for long-term biomass supply as the basis for investments in new capacity; installing new biomass energy and small log processing facilities in Lakeview, to promote cost-effective utilization of the full range of material removed from the forest to meet stewardship and fuel reduction goals; and exploring new ways to manage forest carbon, including developing the science and policy basis for transacting carbon credits from fuel reduction.

LSG efforts have recently borne fruit in six important developments, summarized below.

4.2 Twenty-Year Biomass Supply MOU

After lengthy negotiations, a 20-year Interagency Biomass Supply MOU was signed on November 1, 2007. The parties to the MOU include Lake County Resources Initiative, Lake County, Town of Lakeview, City of Paisley, DG Energy LLC, DG Investors LLC, The Collins Companies, Oregon Department of Forestry, USDA Forest Service Fremont-Winema National

Forest, and Bureau of Land Management- Lakeview District. The purpose of the MOU is to provide a framework for planning and implementing forest and rangeland restoration and fuels reduction projects that address identified resource needs while being supportive of the Lakeview Biomass Project. In the MOU, each of the parties offers specific commitments relevant to fire risk reduction, forest health, biomass energy and a sustainable forest industry in the region. For the Forest Service, these include exploring new long-term supply mechanisms and offering at least 3,000 treatment acres per year within and another 3,000 acres per year outside the Lakeview Federal Stewardship Unit. BLM meanwhile commits to offer 2,000 treatment acres per year District-wide. LCRI's commitments include providing local coordination between the Collins Companies, Jeld-Wen and Forest Service on the WESTCARB project, with the goal of establishing a financing system for reducing uncharacteristically large fire events and provide additional revenues for restoration activities, and working with Iberdrola Renewables to support construction of an appropriately sized (25 MW) biomass plant in Lake County. The Oregon Department of Forestry's commitments include using SB1072 authorities to facilitate 10-year stewardship contracts, developing a cooperative state-wide MOU among state agencies, Forest Service and BLM bringing together elements of existing state programs under Energy, Economic and Community Development, Fish and Wildlife, and Forestry, and supporting the work of federal agencies to develop stewardship contracts and promote bioenergy.

The MOU was reviewed by Forest Service and BLM legal counsel and is in effect. The MOU signing was November 1, 2007, at a ceremony in Lakeview for the launch of the biomass plant and small-log sawmill. Undersecretary of Agriculture Mark Rey was in attendance along with many State dignitaries including two national environment group and two regional environmental groups. The text of the 20-year Interagency Biomass Supply MOU is included in Annex C.

4.3 Ten-Year Stewardship Contract

The efforts of LCRI and its Lake County partners have resulted in a commitment to the first 10-year Stewardship Contract in the US Forest Service Pacific Northwest Region. The contract, considered a model for the region, provides long-term supply of material necessary for the recent investments in a biomass power plant and small log mill described below. The 10-year stewardship contract awarded to the Collins Companies on July 22, 2008 guarantees 3,000 acres of treatment per year and a total of

$100,000 of work over the 10-year period. Specific treatment prescriptions are planned on a two year cycle. The MOU states in addition to the 10-year stewardship contract in the Unit there will be two additional 10-year contracts, one on Forest Service lands outside the Unit and one on BLM lands. There contracts have not been pursued because of the current economic downturn.

4.4 Biomass-Power Plant

Oregon Governor Kulongoski's office and biomass plant developer DG Energy jointly announced in January 2007 that DG Energy will construct a 13 MW biomass plant in Lakeview. This represented the culmination of multi-year efforts by all the partners in the Lakeview

Stewardship Group to reach agreement around sustainable harvest levels and long-term biomass supply mechanisms necessary for investment in new capacity. In their initial efforts to locate a biomass plant in Lake County, LCRI received volume estimates for slash piles that ranged from 1 to 11 bone dry tons (BDT). It is impossible to appropriately size a biomass plant with this range. Using what information was available and a Coordinated Resource Offering Protocol by Mater Engineering it was decided it could sustain a 15 MW biomass plant. Since collecting all the data from the stewardship contracts and other significant information from private lands it has been determined that a 25 MW biomass plant is sustainable.

Marubeni Sustainable Energy subsequently bought the development rights from DG Energy in 2007. In 2009 Iberdrola Renewables purchased the development rights from Marubeni. As a result of new supply information the plant size has gone from a net 13MW to a net 24.9 MW and the investment went from $20 million to over $70 million. Currently the project is scheduled for a final decision on construction this summer 2010 and breaking ground in September 2010 with an estimated completion date of December 2012. The project is designed to use biomass from overstocked forests, helping to reduce wildfires, improve forest health and create jobs. The Lakeview Biomass Project was designated an "Oregon Solutions" initiative by Governor Kulongoski, resulting in a collaborative process involving federal and state agencies, industry, and non-profit organizations to build consensus for the project and secure a sustainable supply of biomass.

The Governor's press release is at http://governor.oregon.gov/Gov/P2007/press_011007b.shtml and is included in Annex D. The Oregon Solutions Declaration of Cooperation is included in Annex E and a 2010 support letter from the Governor is in Annex F.

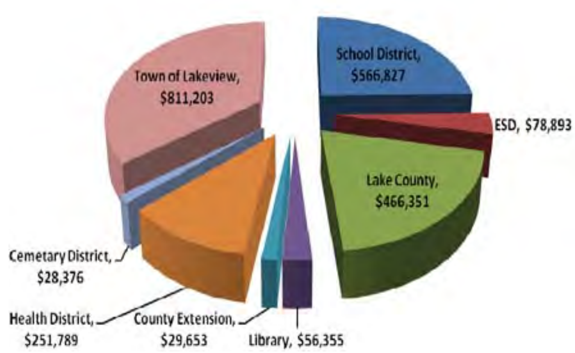
4.5 New Small Mill in Lakeview

Oregon Governor Kulongoski in March 2007 announced that the Collins Companies will expand their Fremont Sawmill operation in Lakeview by building a new $6.8 million dollar small log mill. The small log mill is the direct result of the 20-year Interagency Biomass Supply MOU and 10-year Stewardship Contract efforts spearheaded by LCRI, and provides an added tool for improving management of forests and hazardous fuels in Lake County. The combination of the existing Fremont Sawmill for processing larger logs, the new small-diameter log mill, and the new biomass energy plant will provide the tools necessary for cost-effective utilization of the full range of material removed from the forest to meet stewardship, forest health restoration, and wildfire risk reduction objectives. The biomass plant and small log mill, the result of an "Oregon Solutions" initiative involving nearly 70 public, private and community organizations, represent two sides of "an integrated solution to effective management of forest health and reducing fire danger in the Fremont National Forest. Both the biomass facility and the small log mill serve as models for collaboration between industry, conservationists and state government in enhancing forest health, developing renewable energy and creating jobs" (Governor Kulongoski's press release, March 7, 2007). The full text of the press release is included in Annex D.

A November 1, 2007 ceremony in Lakeview served as the ribbon-cutting for the new small-diameter sawmill and initial kickoff for the biomass energy plant, as well as the signing ceremony for the 20-year biomass supply MOU and announcement of the first 10-year stewardship contract offer by the Forest Service - Pacific Northwest Region.

In addition to the ecological outcomes, the economic outcomes are significant for a rural community. The sawmill and biomass plants are making an $80 million dollar investment in a county that is 78% public ownership. These investments have resulted in retaining 85 sawmill jobs, and will create 18 jobs at the biomass plant and 50-75 jobs in the woods. An Oregon Business 2010 report estimates these investments will have an annual payroll of over $18 million and will pay over $1 million/year in income tax to the State of Oregon (see attached Business Oregon report, Annex G). South Central Oregon Economic Development District estimates that local taxing districts such as the Town of Lakeview, Lake County, Library, Hospital, cemetery, school district, etc. will receive an estimated $1.8 million yearly in taxes. Oregon has established what is called Empowerment Zones and companies locating in these zones can get up to 15 years property tax abatement. The Lakeview Biomass plant is in an Empowerment Zone where they will be paying a substantially less Community Service Fee in lieu of property tax for 15 years. The Biomass Impact to Taxing Districts graph (figure 7) is based on estimated taxes in year 16 and beyond.

Figure 7: Distribution of increased tax revenue resulting from biomass facility in year 16 and beyond.



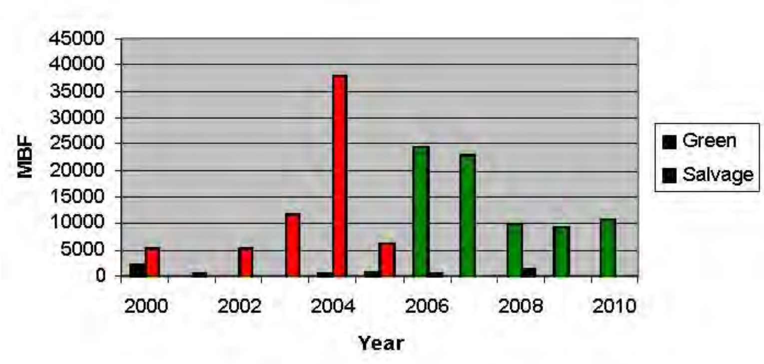
4.6 Influence on Hasardous Fuels Management

Considerable changes have occurred on Fremont-Winema National Forest since the beginning of this project in 2006. The original Forest Service prescriptions for Bull Stewardship, Burnt Willow and Kava were much lighter treatments than treatments currently being implemented by the Forest Service. In designing these projects, the Forest Service was cautious on their prescriptions as they were concerned about possible lawsuits. When the Lakeview Stewardship Group reviewed the completed treatments in these early stewardship projects they informed the Forest Service that treatments need to be heavier in order to reduce fuel loads enough to influence fire behavior and restore natural fire to the landscape. In addition, the Collins Companies invested in a new small diameter sawmill that took merchantable material from a 9”

DBH to a 7” DDH, resulting in an increase in the volume of sawlogs taken off the forest. Another significant change that occurred during the project was the collapse of the economy in 2008 with lumber prices being so low that all sawmills were losing money. Because logging contractors can request an extension to carry out a prescription, this delayed the work until a time when the market returns to more favorable conditions.

The 20-year MOU and the Lakeview Stewardships Group’s 2005 Long-range Strategy for the Lakeview Federal Stewardship Unit was significant enough that The Collins Companies invested $6.8 million in a new sawmill rather than closing down the sawmill. The other significant changes during this time were that the Lakeview Stewardship Group informed the Forest Service they wanted the Forest Service to concentrate on commercial logging operations, and eliminate fire salvage logging. The sawmills viability hinged on getting approximately 20MBF off the Lakeview Federal Stewardship Unit. As a result of the 10-year Stewardship Contract Collins was awarded in 2008, the goal of 20 MBF was exceeded as shown in Figure 8. World market conditions have reduced the amount since 2008, and it will likely climb again with better market return. One of the critical outcomes is that the infrastructure is in place to restore the Forest Service lands to healthy conditions that will be able to adapt to climate change.

Figure 8: Board feet harvested in Lake County between 2000 and 2010 through either salvage logging or green harvests



4.7 Collaborative Forest Landscape Restoration Program (CFLRP)

The National office of the Forest Service announced in February 2010 that they are accepting proposals for the Collaborative Forest Landscape Restoration Program (CFLRP). Projects must be collaborative in nature, address at least a 30,000 acre landscape, and and include a strategic plan. The CFLRP stated that up to 10 projects could be chosen this fiscal year and no more than two from any one region would be funded. Region 6 sent in 5 proposals with the Lakeview Stewardship Group Fremont-Winema proposal being the number 1 priority. Over 10 years this could mean an additional 20 million dollars above regular appropriations for fuels management and restoration in the 500,000 acre Lakeview Federal Stewardship Unit. As part of the CFLRP proposal the Lakeview Stewardship group revised their 2005 Long-range Strategy for the Lakeview Federal Stewardship Unit, see Annex H. Final CFLRP awardees will be notified by late summer.

CHAPTER 5: Conclusions and Recommendations

In both projects, the treatments resulted in significant net carbon emissions[10]. This result clearly has implications for the future potential of fuels treatments as a carbon projects offset category.

The reasons for the net emission from hazardous fuel reductions are multiple. In the case of the Collins- Hot Rocks project, deadwood stocks increased following the treatment. This may be due to an increase in the amount of limbs and branches left following the treatment. Because the projects included sawtimber removal, the live standing carbon removed was substantial. However, due to milling inefficiencies and the retirement of wood products over time, only a fraction of the carbon removed as sawtimber is stored in wood products over the long term. Had it been possible to utilize biomass for energy production, some of the emissions may have been offset, but there would still be net emissions as a result of treatment. As it was, the piling and burning of biomass further contributed to overall emissions.

While the Bull Stewardship treatment led to a slight decrease in fire intensity, the Collin-Hot Rocks treatment led to an increase in fire intensity, and both led to an increase in potential emissions from a fire. Both treatments led to a substantial increase in large woody fuel loads and subsequent biomass consumption. If the woody fuels that resulted from the treatments been removed from the site, there likely would have been a decrease both in surface fire behavior and potential carbon release. Both treatments produced an apparent decrease in crown fire potential from future fires, which reduces the severity and size of wildfires, and improves the ability to control a fire.

The rate of growth increased slightly following the treatments, but in the absence of a wildfire, total carbon stocks in the treated areas still had not surpassed those in untreated areas after 60 years.

Following a wildfire, carbon stocks continued to decline for both the treated and the untreated stands.

Within the treated areas, both projects had significant net emissions when considering treatment and the risk of a potential wildfire. If a fire were to occur in the year of treatment, all projects would still experience net emissions, though the impact of treatment emissions would be slightly reduced.

One critical factor not addressed in this study is the impact of fuels treatment on fire intensity and emissions outside the treated area itself. In many cases, the reduced intensity of fire in a treated area decreases the intensity of fire in the surrounding untreated areas, increasing the

[10] A complete accounting of emissions would have also incorporated equipment use. Though this project did not address equipment emissions, a similar project in Shasta County found emissions ranging from 0.8 to 1.8 tons CO2/ac. While this is not an insignificant amount, it is a small fraction of the emissions which result from the removal of biomass from the forest

beneficial aspects of the treatment without removing additional biomass. This is often referred to as a fire shadow. The size of a fire shadow along with the level of reduced emissions varies based on a number of factors, including topography, location of treatment, climatic conditions, and fire intensity. Incorporating the fire shadow in the overall emission calculations would decrease the net emissions in most cases, but given the extent of emissions for both projects, it is likely that inclusion of a fire shadow would yield lower emissions but significant emissions would still result from treatment.

Both pilots led to a decrease in crown fire potential, which decreases fire severity and size. While treatments lead to net carbon emissions in both the short and long term in both projects, there are, of course, additional benefits to fuels treatments, such as increased ability to successfully fight fires and decreased cost of fire fighting; reduced loss of life and property; and reduced potential damage to wildlife habitat.

These results are mirrored well in the results from the Alder Springs treatment in Mendocino National Forest conducted under funding from the US Forest Service. In Alder Springs, net emissions of 26.3 tons of carbon dioxide per acre were recorded immediately after treatment climbing to a total of 86.9 t CO_2-e/ac after 60 years.

The results from this study in combination with the paired study in Shasta County and the allied study in Mendocino National Forest underline the unsuitability of fuels treatment as a potential greenhouse gas offset generating activity. Instead we argue the shift should be made to policies minimizing greenhouse gas emissions from wildfires and from fuel treatments while minimizing wildfire risks to lives, homes and livelihoods in the WESTCARB region.

5.1 Benefits to California

The research questions being explored in Lake County, and the validation and demonstration of new climate change mitigation opportunities, are equally relevant to California's public and private forests. Debates around managing the multiple economic, social and ecosystem benefits of the State's forests, and the need for creative and aggressive approaches to managing catastrophic wildfire at California's wildland-urban interface, have risen to prominence in the media and public consciousness. Moreover wildfire conditions are projected to worsen with global warming (California Energy Commission 2006), making new strategies for managing the fire-prone forests an important climate adaptation as well as climate mitigation opportunity.

Results from the Lake County, Oregon and Shasta County, California[11] hazardous fuel reduction pilot activities indicate that hazardous fuels treatments do not represent potential carbon offset projects. A third WESTCARB report[12] discusses in more depth the reasons such

[11] Goslee, K., T. Pearson, S. Grimland, S. Petrova, and S. Brown. 2010. Final Report on WESTCARB Fuels Management Pilot Activities in Shasta County, California. California Energy Commission, PIER. CEC-500-2014-107.

[12] Pearson, T., K. Goslee, and S. Brown. 2010. Emissions and Potential Emission Reductions from Hazardous Fuel Treatments in the WESTCARB Region. California Energy Commission, PIER. CEC-500-2014-046.

projects do not lead to offsets and addresses shortcomings of similar research that has indicated otherwise.

Regardless of these findings, wildfire poses a significant threat to ecosystems, property, and people, and fighting wildfire represents a large investment of resources. Carefully planned and properly implemented hazardous fuels treatments are a critical means of ensuring the safety of nearby communities and the health of forests. In addition, fuels treatments can lead to increased timber production and reduced costs of fighting fires. While there may not be an opportunity to reduce wildfire emissions on a project by project basis, it is imperative that sound wildfire preventative strategies continue to be employed in California forests.

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Western Climate Initiative. August 22, 2007. Statement of Regional Goal.

APPENDIX A:
Protocol for Monitoring and Estimating Greenhouse Gas Benefits from Hazardous Fuels Management in Western U.S. Forests

WINROCK SOP

Standard Operating Procedures for Fuels Measurements

WINROCK INTERNATIONAL

CONTENTS

SOP GLOBAL POSITIONING SYSTEMS

All permanent plots that are established must have GPS coordinates to ensure the plot can be relocated in future inventories.

- The default geodetic datum for most GPS units is WGS84 which is acceptable
- The coordinate system should be the same for all fieldwork
- An advanced user can pick a projected coordinate system appropriate for that location on the planet. A novice should use a geographic coordinate system based on WGS84 geodetic datum and record the coordinate pairs in decimal degrees.
- The coordinate system and datum used must be recorded on the field notes
- The data should be collected using metric units not English units

Uploading Plot Coordinates to GPS Unit

The plot coordinates will provided before the start of fieldwork. These coordinates can be uploaded to a GPS unit either manually, or using a fairly user-friendly software program called DNR Garmin Extension. The extension can be downloaded from http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html . Please follow instructions for software installation.

Once installed, follow these two steps to upload coordinates from your PC into the GPS unit:

1. Load data from a file or GIS graphic into the DNRGarmin Data Table

   Go to File => Load From and choose a source (File, Arcview, Landview, Arcmap). Select PLOT field as Identification field and select TODAY'S DATE as Comment field. Note: You can only load from Arcview/Landview/Arcmap if that software is running. Also, to upload from Excel rather than Arcview, you may need to export the Excel to a database format (.dbf) first.

2. Upload data to the GPS

   Depending on the radio dial you have selected (Waypoint), go to that shape type's menu and select Upload (**Waypoint => Upload**). The data will be uploaded into your GPS. Check whether the points are on your GPS unit.

Navigating to Plot Centers

Once you have all the plot coordinates in the GPS, travel to each unit where treatment has been completed. Once in a unit, navigate to each plot using the "navigate" or NAV function on the GPS. Set the unit to the nearest plot and let the GPS tell you where to go. Make sure GPS unit is set to WGS84 projection.

At each plot center, please re-record the GPS coordinates (take a point and note the point number).

SOP ESTABLISHMENT OF PLOTS

Required equipment:

All Plots

GPS

Flagging tape

Clinometer

Iron bar about 1-2 cm in diameter and approx. 20 cm long

Hammer

Fluorescent paint

Permanent marker

The plot should be navigated to using a GPS. On occasion the plot will fall in an area of mixed slopes. One portion of the plot might be on level ground but another portion might fall on a hillside. Since the plot dimensions are a function of slope, it is important to establish the plot center in an area that is either on a slope or on level ground. The potential for error is too high to have a portion on sloping land and the other portion on level ground. Therefore, prior to establishing a plot it should be determined if any portion of the plot will be on a slope > 10 %. If more than 50 % of the plot falls on a slope > 10 %, move the plot center so that the entire plot is located on the slope. If more than 50 % of the plot is located on level ground, but the rest of the area is on a hillside (slope > 10 %) move the plot center so that the entire plot will fall on level ground.

If the plot has been moved record GPS coordinates for the center of the plot.

If the slope is greater than 10 % record the exact slope for later correction of plot area.

To record the slope use a clinometer. Stand upslope and sight the head of someone of a similar height and record either the % slope of the angle of the slope in degrees (include units on the worksheet).

Establishing Plot Marker

Plots are given a unique number/name.

- The first number/letter should indicate the site – such as National Forest X or Land Belonging to Private Company Y.
- The second number/letter describes the specific unit
- The last number/letter should indicate the plot number within the unit

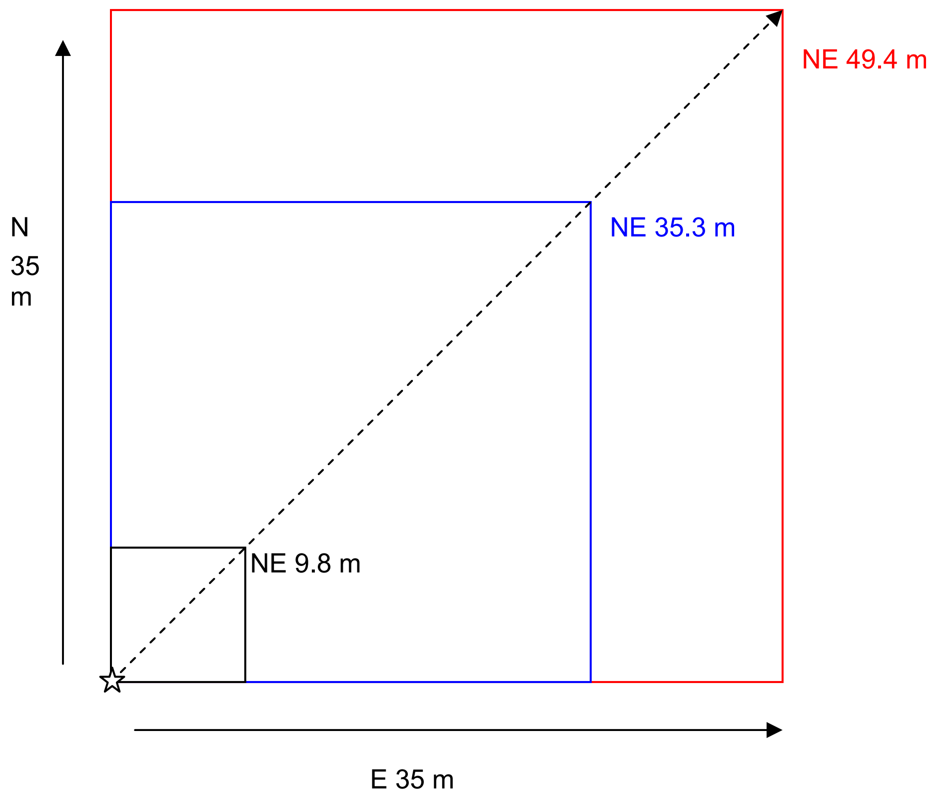
At the plot marker point, sink the iron bar into the ground using the hammer. Leave approximately half an inch above the ground. Spray the tip with fluorescent paint and then tie flagging tape to the tip. Mark on the flagging tape the unique number/name of the plot.

Tree Plot Structure

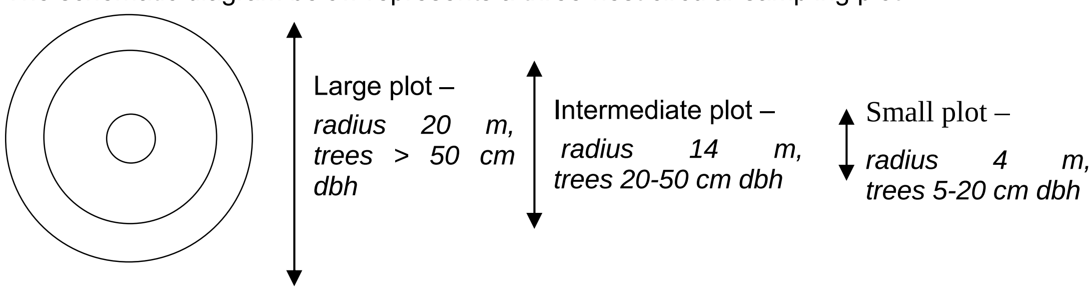
Typically we measure trees measuring between 5 cm and 20 cm at breast height within 4 m of the plot center, trees measuring between 20 and 50 cm within 14 m of the plot center and trees measuring greater than 50 cm at breast height within 20 m of the plot center.

If distance measuring equipment is not available it may be more time efficient to measure in square rather than circular plots and to lay out the plot boundaries using rope during measurement.

One protocol for doing this may be to measure out 35 meters of rope to the East and 35 meters of rope to the North from the marked plot center. Returning to the center measure out 49.4 m to the Northeast and mark the corner before laying down line to complete the four sides of the square. Then along the North and East lines mark off 7 meters and 25 meters. Walking northeast from the plot center again mark off corners at 9.8 m and 35.3 m and complete these squares with rope.



The schematic diagram below represents a three-nest circular sampling plot.



SOP MEASUREMENT OF TREES

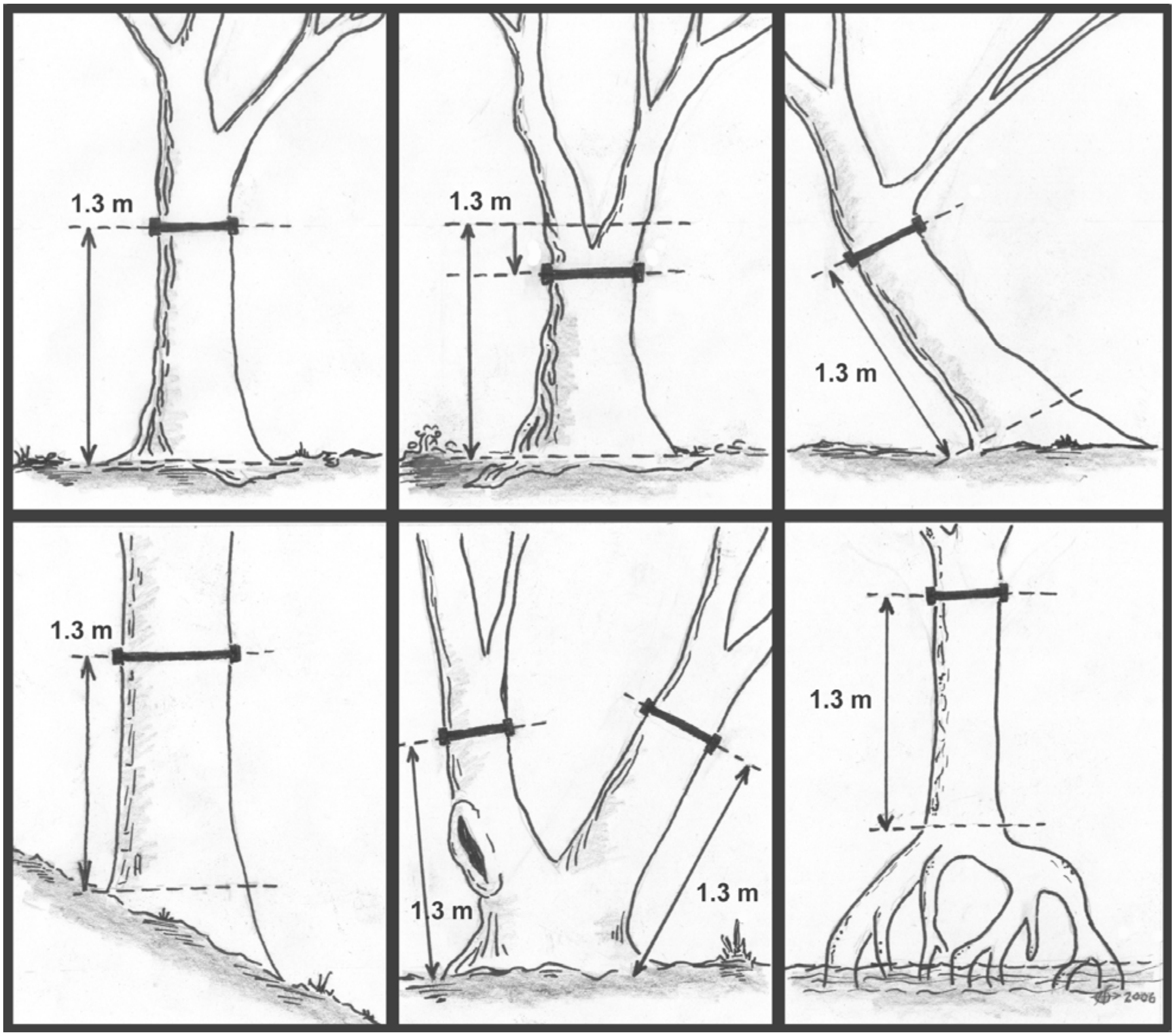
Field equipment:
DBH tape
Flagging tape
1.3 m pole
Spray paint

Initial Measurement

1. Assign one person to record the data and all others should be measuring and marking trees. The recorder should stand in the center of the nested plot being measured. He or she should track those measuring the trees and should endeavour to assure that no trees are missed
2. Count the number of trees with a dbh of less than 5 cm in a radius of 1m from the plot marker, only include if the tree has a measurable dbh.
3. Measurement in each of the other nested plots should be conducted in turn. So that all trees should be measured in the smallest plot, followed by all trees over 20 cm dbh in the additional area included by expanding to the middle plot followed by all trees over 50 cm dbh in the additional area included by expanding to the largest plot.
4. To avoid either missed trees or double recording, measurement should begin to the North and the first tree should be flagged
5. Marking trees
    a. All trees in long-term measurement plots should be marked with a unique number using spray paint
    b. It is important to use a paint designed for the marking of trees and it is important that the color is different to any color that is being used in the forest to indicate treatments or which trees to cut and which to leave
    c. Begin with number 1 in the smallest plot and continue sequentially upwards. If there are multiple people measuring trees then the person recording the data is responsible for assuring that each tree has a unique number
    d. Paint the number on the tree facing towards the plot center
6. All trees should be measured at 1.3 m
    a. It is important that a DBH tape is used properly to insure consistency of measurements.
    b. Place the 1.3 m pole stick against the tree to indicate the location of DBH. Placement of the measuring stick depends on the slope of the ground as well as the tree's shape.
        i. Always place pole and measure DBH on the *upslope* side of the tree
        ii. Always measure 1.3 m parallel with the tree, *not* perpendicular to the ground. Therefore, if the tree is leaning, measure 1.3 m from the upslope side of the lean, parallel with angle of tree.
        iii. Trees are considered alive if there are green leaves present. Even if there are only one or two green leaves present the tree is considered alive.
    c. Measure DBH
        i. Measure trees of appropriate sizes for each nested plot.
        ii. If tree is in dead class 1, mark as dead on data sheet

iii. If the tree is forked at DBH, measure the diameter just below the fork and tag the tree, Record as if it were one tree on the data sheet, but with a note that the diameter is below the fork.

iv. If using a standard DBH tape, the DBH tape has a hook on the end. Push the hook into the bark of the tree and pull the tape to the right. The DBH tape should always start left and be pulled right around the tree, even if the person taking the measurement is left-handed. As the DBH tape wraps around the tree and returns to the hook the tape should be above the hook, as shown below. The tape should not come around the tree below the hook. The tape should not be upside down; the numbers must be right side up



7. Record species or species group
    a. If you know the species record it
    b. If you do not know the species record the species group: fir, pine, aspen, hardwood or other
8. Boundary trees

Occasionally trees will be close to the border of the plots. The plots are relatively small and will be expanded to estimate biomass carbon on a per hectare basis. It is therefore important to carefully decide if a tree is in or out of a plot. Measure the distance from the plot center to the tree in question, if more than 50% of the trunk is within the boundary the tree is in. If more than 50% of the trunk is outside of the boundary it is out and should not be measured. If it is exactly on the border of the plot, flip a coin to determine if it is in or out.

9. When all of the trees in the plot have been measured, there should be a double-check to see that all of the trees have been measured and tagged.

Post Treatment Remeasurement

Before going in the field, data sheets should be prepared listing each of the trees initially measured.

Record the Plot ID number.

On the datasheet mark if each numbered tree is still present. Search carefully so that all trees are included. Trees are not necessarily numbered sequentially as you go around the plot, but all numbers should be present unless a tree has been harvested. Remember that any tree <20 cm DBH will only be in the smallest plot.

If there is a tree that doesn't have a number on it but in your opinion should (, then measure its diameter at breast height and record whether it is a fir, pine, aspen or other.

For any tagged trees which cannot be found a note of MISSING should be placed on the data sheet. If a tree has been harvested since the last inventory, a note of HARVESTED should be place on the data sheet. If a tagged tree has died since last inventory, a note of DEAD should be placed on the data sheet and 'SOP 13 Measuring Dead Wood' followed.

SOPS ADDITIONAL TREE PLOT MEASUREMENTS

Take a Photograph

Take a photograph standing to 2 m to the north of the plot marker facing the plot marker (i.e. facing south). Make a note of the photograph number in the space provided on the field data sheet.

Measure Tree Heights and Height to Live Canopy

For trees number 1, 6, 11, 16, 21 etc measure the height of the tree using a clinometer and tape measure or a laser rangefinder. Subsequently for the same trees measure the height to start of the live canopy.

Measuring heights

-Use clinometer to estimate % to top of tree

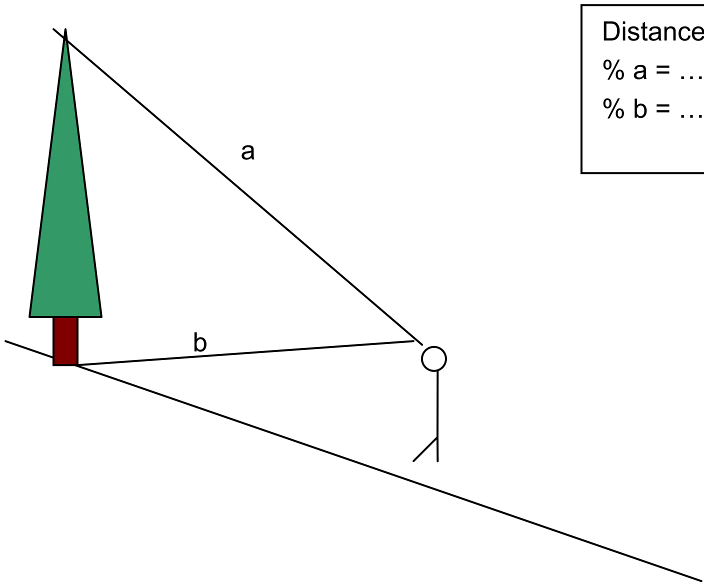
-Use laser range finder to measure distance to tree

-Know the height from the ground to your eye.

If not flat, note this and measure % to bottom of tree

Include a diagram showing which measurement applies where

-Distance to tree must be measured in a perfectly horizontal line, if slope is such that your head is below the bottom of the tree, measure distance to top of tree (using laser) and using the clinometer the angle in degrees to top of the tree[1].



Distance to tree = …….
% a = ………
% b = ………

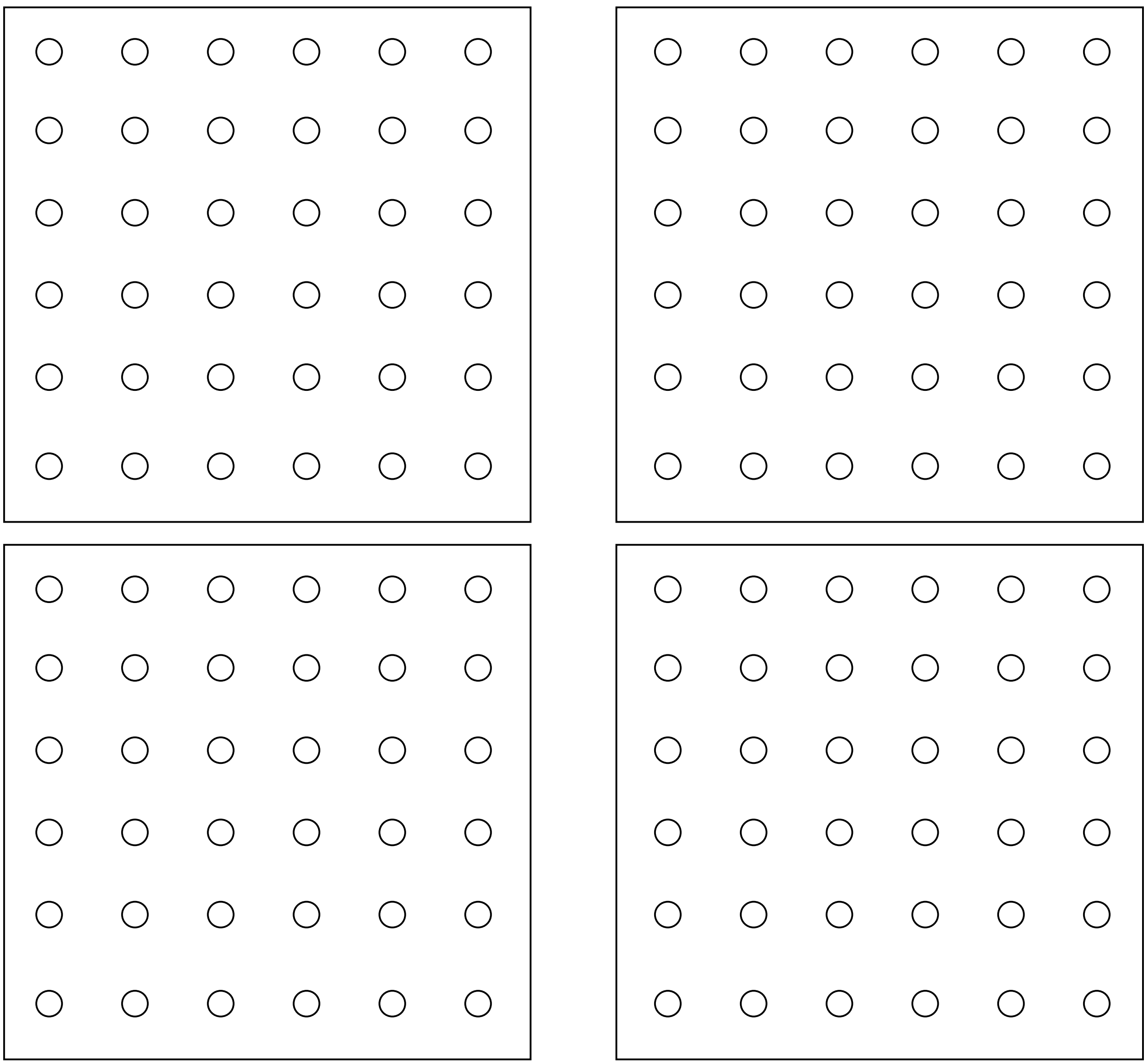
Using a clinometer

- Hold clinometer up to your dominant eye, the string on the clinometer should be below the eye piece
- Keep both eyes open and simultaneously look at the numbers through the clinometer and the object you want to measure in the distance
- The units on the right are %, on the left are degrees. Use percent wherever you can but note carefully if you do not. To look directly overhead use degree and tip your head back until you see 90.

[1] Horizontal Distance = Cosine of angle x distance to top of tree.

Canopy Cover

1. Lay down a tape measure along 15 m transect.
2. Start at 0 cm and use the densitometer. Looking through the densitometer you can see two spirit levels. When both are centered you are looking directly overhead. In the center of the field of vision there is a small circle. If you can see leaves within this circle then fill in the first circle on the grid (on next page), if not leave blank.
3. Move forward 3 m and repeat.
4. Move forward 3 m repeatedly until reach 15 m (6 recordings)
5. Move tape measure 3 m to your right and repeat measurements along line.
6. Move tape measure 4 more times until 6 lines have been completed and all 36 circles have either been filled in or left blank.



SOP MEASUREMENT OF STANDING DEAD WOOD

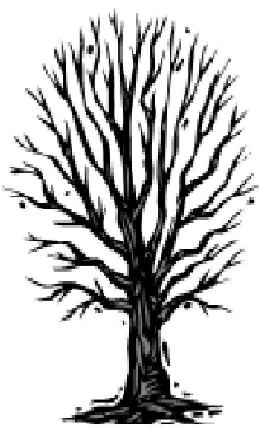
Field Equipment:
DBH tape
Clinometer
Laser range finder
Transparent ruler or relascope
Measuring tape

Within plots delineated for live trees, standing dead trees should also be measured. Standing dead trees should be classified into two classes:

Class 1: Tree with branches and twigs and resembles a live tree (except for leaves)

Class 2: Trees ranging from those containing small and large branches to those with bole only

By classifying trees into these two simplified classes, a conservative estimate of biomass will be taken.


Class 1


Class 2


Class 2

Class 1 trees:

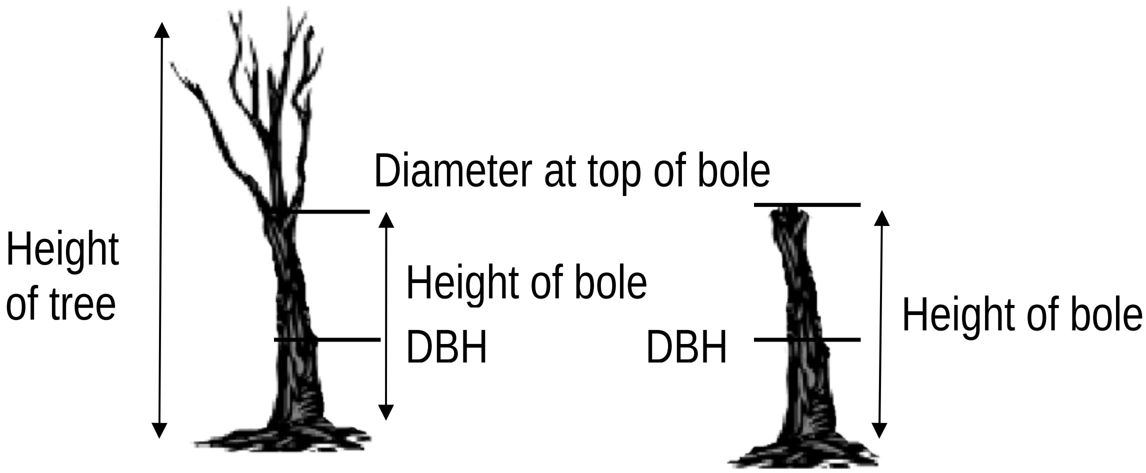
1. Measure DBH using methods for live trees. If nested plots are used, only dead trees of the appropriate DBH should be measured for each nest.

Class 2 trees:

1. Measure DBH using methods for live trees. If nested plots are used, only dead trees of the appropriate DBH should be measured for each nest.
2. Measure height of bole using a clinometer
3. Estimate diameter at top of bole using either:
    a. Relascope or
    b. Transparent ruler
        i. Hold the ruler approximately 10-20 cm from your eye
        ii. Record the distance from the ruler to your eye
        iii. Record the apparent diameter of the top of the tree
        iv. Measure the distance from your eye to the tree using a laser range finder
        v. The true diameter is then equal to:

$$\text{True Diameter (m)} = \frac{\text{Distance Eye to Tree (m)}}{\text{Distance Eye to Ruler (m)}} * \text{Ruler Measurement (m)}$$

4. Use the average density calculated for 'sound wood' in calculation of carbon stock.



SOP MEASURING NON-TREE VEGETATION AND LITTER

Field Equipment
Clip plot
Measuring tape
Clippers to remove vegetation
Hanging scale
Durable plastic sheeting
Durable plastic tarp
Paper bags
Compass

Non-tree vegetation includes grasses, non-woody vegetation, shrubs and trees that have not attained a diameter at breast height.

Measurement of Large Shrubs

Within the smallest square or circular measurement plot (e.g. the 4 m radius plot) record the basal diameter of each shrub. For each measure the maximum height of the shrub and the diameter of the crown of the shrub North to South and East to West. If known also record the species.

Measurement of Remaining Non-Tree Vegetation and Litter

Sampling for the remaining pools of non-tree vegetation and litter should occur at 2 locations within the tree plots. The non-tree vegetation will include tree seedlings that have not yet reached sufficient height to have a dbh, small shrubs and herbaceous vegetation. Clip plots should be used to sample this non-tree vegetation. These plots can be circular or rectangular and can be made out of various materials. A square clip plot made of pvc pipe 30 cm x 30 cm is usually sufficient for sampling.

The litter layer is defined as all dead organic surface material on top of the mineral soil. Some of this material will still be recognizable (dead leaves, twigs, dead grasses, and small branches) and some will be unidentifiable decomposed fragments of organic material. Note that dead wood with a diameter of less than ¼ inch is included in the litter layer.

1. Record the dimensions of the clip plot on the data sheet
2. From center of plot, walk 5 m to the South of the plot marker.
3. Place clip plot at this location
4. Clip all vegetation originating from inside the plot at ground level. Place on the plastic sheeting or tarp.
5. Weigh the total amount of clipped vegetation and record the weight on data sheet.
6. From the total amount of clipped vegetation, take a representative subsample.
7. Collect all litter inside the frame. A knife can be used to cut pieces that fall on the border of the sampling frame. Place the litter on the plastic sheeting or tarp.
8. Weigh entire sample using sheeting or bag and hanging scale.
9. Mix the litter thoroughly and collect a subsample (approximately 80-100 g) that is representative of the material found in the litter.
10. Weigh subsample and record weight.
11. Place subsample in paper bag, label and bring out of field
12. Repeat for location 5 m to West of plot marker.
13. Later oven-dry subsample of non-tree vegetation at 70ºC to a constant mass, and oven dry litter subsample (at 80^{o} C) to a constant mass and weigh both with laboratory scale

When returning for post-treatment remeasurement place clip plots 5 m to the North and to the East of the plot marker.

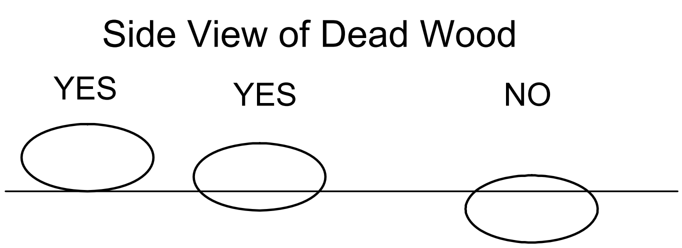
SOP MEASUREMENT OF LYING DEAD WOOD

Field Equipment:
Calipers (preferred) or DBH tape
Measuring tape
Machete or knife
50 m line with marks on the line indicating 2m and 4m

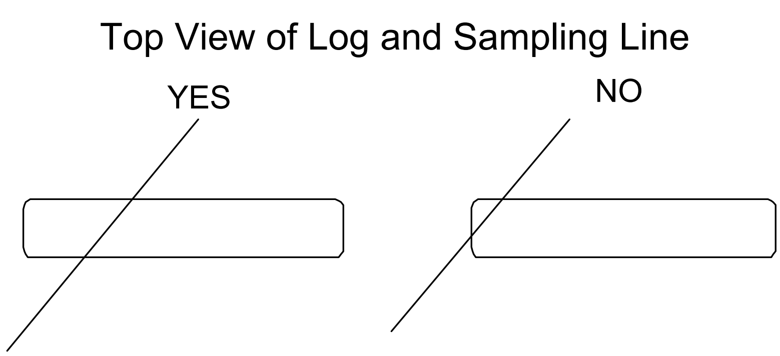
Lying dead wood will be measured using the line-intersect method outlined in Harmon and Sexton (1996). Lying coarse dead wood is defined as all woody material on the ground with a diameter ≥1/4”.

1. From the plot marker, lay out the 50 m line to the South.
2. Along the length of the line measure the diameter of each intersecting piece of coarse dead wood (≥ 3” diameter). Calipers work best for measuring the diameter. It is time efficient to measure a twig or similar to 3 inches and to use this as the reference for determining whether or not to go ahead and measure a piece of wood. When measuring the diameter of dead wood it is not always possible to place a tape around the log. It can also be dangerous because logs are usually home to snakes, spiders, etc. If you are going to measure the diameter of the piece of dead wood with a diameter tape, make sure the route is clear before placing your hand underneath the log.

   A piece of dead wood should only be measured if: (a) more than 50% of the log is aboveground, and (b) the sampling line crosses through at least 50% of the diameter of the piece (Figure 14-2). If the log is hollow at the intersection point, measure the diameter of the hollow; the hollow portion in the volume estimates is excluded. Some examples are displayed below:



The first two logs should be measured because the log is more than 50% above ground, but the third log should not be measured.



The first log should be measured because the sampling line crosses more than 50% of the diameter of the log. Conversely, the second log should not be measured because the sampling line does not cross more than 50% of the log diameter.

3. Assign each piece to one of three density states: sound, intermediate, or rotten. To determine what density class a piece of dead wood fits into, each piece will be struck with a machete or knife. If the machete or knife does not easily sink into the piece (bounces off), classify it as sound. If the machete or knife sinks partly into the piece, and there has been some wood loss, classify it as intermediate. If the machete or knife sinks easily and entirely into the piece, if there is more extensive wood loss, and the piece is crumbly, classify as rotten. Record on data sheet.
4. The volume of lying dead wood and then carbon stocks will be estimated using the diameters of each piece of wood and the length of the line transect.
5. From zero to 2 m along the line, count the number of pieces of dead wood with a diameter of ¼” to 1” that the line crosses. Count these only; no need to record their dimensions or density class. Record on data sheet.
6. From zero to 4 m along the line, count the number of pieces of dead wood with a diameter of 1” to 3” that the line crosses. Count these only; no need to record their dimensions or density class. Record on data sheet.
7. Lay the line out to the West of the plot marker and repeat measurements.

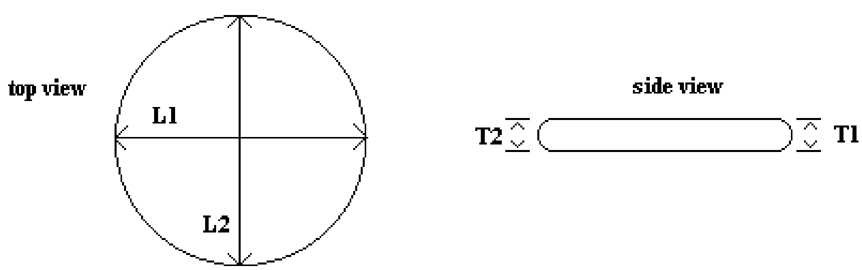
At the time of remeasurement lay lines out to the North and East instead of South and West.

SOP MEASUREMENT OF DEAD WOOD DENSITY

Field Equipment:
Measuring tape
Chainsaw or handsaw
Paper bags
Permanent marking pen

At the time of pretreatment field sampling, estimates of dead wood densities need to be taken if standing dead or lying dead wood will be sampled. If the decomposition of wood is predicted to be different within each strata, then this SOP needs to be repeated for each strata. If only the standing dead wood pool is being measured, then only the density of 'sound wood' needs to be estimated. After these densities are determined, this SOP does not need to be repeated unless a new strata is measured.

1. Randomly locate an area that is representative of strata/area.
2. All dead wood will be classified into three density classes: sound, intermediate, and rotten.
    a. Sound: Machete does not sink into the piece (bounces off)
    b. Intermediate: Machete sinks partly into the piece, and there has been some wood loss
    c. Rotten: Machete sticks into the piece, if there is more extensive wood loss, and the piece is crumbly
3. Collect wood samples for each density class for density (dry weight per green volume) determination. The number of wood samples will depend on the variability between tree species within the forest. A minimum of 10 samples should be collected for each density class of each species group. For example, for a forest containing mixed broadleaf and palm species , a minimum of 10 samples of dead wood from each tree group should be collected per density class—for a total number of 30 samples for broadleaf species and 30 for palms.
    a. Using a chainsaw or a handsaw, a complete disc from the selected piece of dead wood can be cut.
    b. Measure the diameter (L1 and L2) and thickness (T1 and T2) of the disc to estimate volume.
    c. The dimensions of the sample should be recorded on data sheet. The fresh weight of the disc does not have to be recorded.



    d. Alternatively volume can be derived through use of the Archimedes principle whereby the volume of water displaced by the sample is equal to the volume of the sample. For this method you will need to use a bucket and a measuring cylinder.

4. Place sample in paper bag and bring out of field
5. Oven dry disk (80^{o} C) to a constant weight
6. Weigh disk with laboratory scale
7. Calculate density using the following formula:

density = mass (g) / volume (cm^3)

Where:

mass = the weight of the oven dried sample

volume = π * (average diameter/2)^2 * average width of sample

8. Mean the densities for each density class to create an average density for sound, intermediate and rotten samples.

APPENDIX B:
Developing and Testing a Framework for Estimating Potential Emission Reduction Credits: a Pilot Study in Shasta County, California, USA

MAY 2010

Long-range strategy for the Lakeview Federal Stewardship Unit

Forest and Rangeland Health, Soils and Water
Fish and Wildlife, Wilderness and Roadless Areas
Recreation, Community Benefits
Forest Restoration
Economics

prepared by:

LAKEVIEW Stewardship Group

2010 LONG-RANGE STRATEGY FOR THE LAKEVIEW FEDERAL STEWARDSHIP UNIT

PREPARED BY THE LAKEVIEW STEWARDSHIP GROUP

Original Authors and Contributors (November 2005):

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ACKNOWLEDGMENTS

The Lakeview Stewardship Group and Lake County Resources Initiative appreciate the assistance and support of several individuals and organizations in producing this updated long-range management strategy for the Lakeview Federal Stewardship Unit. The following individuals commented on a review draft of the original 2005 strategy: Dr. Norm Johnson (Oregon State University), Dr. Jerry Franklin (University of Washington), Chris Maser (consulting ecologist), Susan Jane Brown (Pacific Environmental Advocacy Center), Doug Heiken (Oregon Natural Resources Council), David Bayles (Pacific Rivers Council), Dave Wenzel (retired US Forest Service), and Chuck Graham (retired US Forest Service). Norm Michaels, Sue Puddy, and other Forest Service staff of the Fremont-Winema National Forest also commented on drafts of the original strategy. Jennifer Stephens of The Wilderness Society helped with publicity and final production of the document. The Liz Claiborne and Art Ortenberg Foundation, Flintridge Foundation, Weyerhaeuser Family Foundation, National Fish and Wildlife Foundation, Bullitt Foundation, and National Forest Foundation have provided financial support for this and other collaborative activities in the Lakeview Unit.

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(Maps prepared by Chris Weller and Bo Wilmer with The Wilderness Society's Center for Landscape Analysis and by Chris Zanger with The Nature Conservancy's Fire Learning Network)

EXECUTIVE SUMMARY

LONG-RANGE STRATEGY FOR THE LAKEVIEW FEDERAL STEWARDSHIP UNIT

The Lakeview Stewardship Group envisions a sustainable forest ecosystem that, through a new understanding of the interrelationships between the people and the land, will ensure quality of life for present and future generations.

This updated long-range strategy is part of a unique, collaborative effort to help restore the ecological health of the 500,000-acre Lakeview Federal Stewardship Unit in the Fremont-Winema National Forest and provide economic and social benefits for the local community. The strategy is based on a common vision and set of goals and objectives developed by the Lakeview Stewardship Group and adopted by the U.S. Forest Service. The Lakeview Stewardship Group includes conservationists, timber workers, local government officials, the Bureau of Land Management, and other civic leaders working in cooperation with the Forest Service. Originally released in November 2005, the strategy has been updated in 2010.

The Lakeview Federal Stewardship Unit was originally established in 1950 as the Lakeview Federal Sustained Yield Unit for the purpose of supplying timber to local mills in the communities of Lakeview and Paisley in Lake County. In 2001, the Chief of the Forest Service re-authorized the Unit with a revised policy statement that established new goals and updated its name to the Lakeview Federal Stewardship Unit.
The goals of the Stewardship Unit are as follows:

- Sustain and restore a healthy, diverse, and resilient forest ecosystem that can accommodate human and natural disturbances.
- Sustain and restore the land's capacity to absorb, store, and distribute quality water.
- Provide opportunities for people to realize their material, spiritual, and recreational values and relationships with the forest.

To achieve the collaborative vision and goals of the Unit, the long-range strategy takes a holistic and scientific approach toward restoration. The strategy builds on regional ecosystem assessments and local watershed analyses by the Forest Service and BLM, as well as independent scientific and university studies. It is also informed by the results of an intensive seven-year monitoring program conducted by Lakeview-area high school graduates under the supervision of experienced scientists.

The strategy recognizes that restoration of the Unit will require comprehensive solutions to a variety of often inter-related problems. For example, decades of aggressive fire suppression and intensive logging of old-growth ponderosa pine trees have created unnaturally dense young forests, excessive fuel loads, and much greater risk of severe fires. Absence of fire has altered the forest species composition with increases in white fir, lodgepole pine, and western juniper above historic levels. Lodgepole pine has spread into wetlands and riparian systems. Changes in forest species composition and density have increased the incidence and risk of insects and disease, reduced biodiversity and resiliency of trees, and affected the hydrologic regime. Also, past road building and grazing have altered the hydrologic regime through the timing and magnitude of stream flows, removed and altered riparian area vegetation, changed channel morphology, altered sediment transport, and reduced in-stream habitat. In addition, invasive plants such as cheatgrass are spreading rapidly to the detriment of native grasses, aspen groves, sagebrush, meadows, and other important habitats. Climate change may be exacerbating these problems now and in the future.

To address the risks associated with climate change, altered forest structure, and altered fire regimes, we have developed a strategic approach that prioritizes treatments based on restoration of key values and fuels reduction. The strategy recommends an accelerated thinning and prescribed burning program, focused on the relatively dry, low-elevation ponderosa pine and mixed conifer forests. Where appropriate, proposed treatment areas may extend onto adjacent BLM administered lands. The remaining large, fire-resistant, old-growth trees should be retained wherever possible. Additionally, considerable care must be taken to monitor watershed processes, and to protect the soil from excessive disturbance, compaction, erosion, loss of nutrients, and invasive plants. Restoration treatments will require no new permanent roads, and any temporary roads will be promptly decommissioned as part of the stewardship contract.

The strategy calls for continuing and expanding the Lakeview monitoring program to ensure that management actions are having the intended effect and can be quickly modified based on locally relevant new information. It also points out the need to upgrade logging equipment and develop new equipment that is affordable in order to minimize roads, soil compaction, and other potential impacts of an expanded thinning program.

Additional actions are needed to restore high-quality habitat and healthy populations of fish and wildlife. Closing unnecessary roads will benefit big game populations as well as improve water quality and stream habitats. Native riparian vegetation such as willows and aspen should be restored, and barriers to fish passage removed.

The strategy recognizes that not all the Lakeview Unit is equally in need of restoration work. About one-eighth of the Unit is in either the Gearheart Mountain Wilderness or the Unit's seven inventoried roadless areas. The strategy recommends keeping the roadless areas free of road building and logging.

The Lakeview Unit provides important social and economic benefits to the nearby communities. It supplies about 10-15 percent of the timber processed by the Fremont Sawmill and its 100 employees. Many local residents obtain their firewood, Christmas trees, and other forest products from the Unit. About 34 businesses and families graze livestock within the Unit for part of the year.

The Unit also offers many recreational facilities, attractions, and opportunities that contribute to the enjoyment and quality of life for local residents and visitors alike. However, widespread mortality of mature lodgepole forests and reduced federal funding for recreation have put some campgrounds and other recreation sites in jeopardy.

The communities of Lake County have struggled to maintain or diversify their economies. While fairly typical of rural Northwest communities in regard to socio-economic distress, Lake County's remote location and lack of transportation options pose special difficulties for economic development. Local contractors need to have easier access to job opportunities created within the Unit.

The Collins Companies' addition of a $6.8 million small-log mill to the Fremont Sawmill in 2007 was an important investment in the future of the Lakeview community, as well as a turning point for restoration forestry in the Lakeview Stewardship Unit. In order to promote steady supply and utilization of small-diameter trees in the Unit, Collins and the Forest Service that same year created the first and only ten-year stewardship contract in the Pacific Northwest. The stewardship contract was also intended to increase implementation of other restoration activities in the Unit through trading of goods-for-services. However, the severe economic recession that hit the wood products industry beginning in 2008 has limited the amount of restoration work that can be accomplished through stewardship contracting.

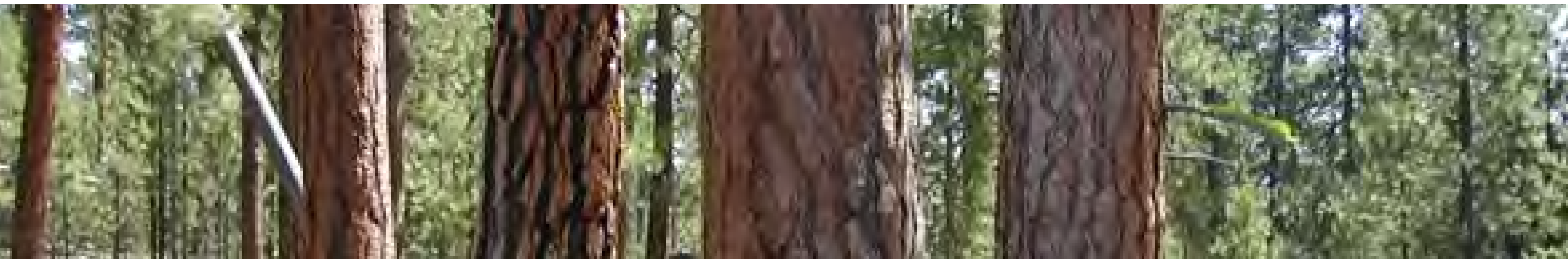
Building a biomass plant is a key objective to improving the local economy and helping accomplish ecologically beneficial thinning projects within the Unit. In 2007, under the auspices of the Oregon Futures program, numerous public and private entities signed a 20-year memorandum of understanding to develop a woody biomass industry in the Lakeview community. Despite unforeseen obstacles and setbacks, efforts continue to begin construction of an economically viable and appropriately sized biomass plant.

Since the Long-Range Strategy was adopted in 2005, the Forest Service has collaboratively planned and implemented several restoration projects in the Unit that are consistent with the goals of the Unit and the recommended guidelines of the Strategy. The West Drews project, for example, authorized 15,000 acres of thinning, 26,000 acres of prescribed burning, and 90 miles of road decommissioning – all with a single environmental assessment and without an administrative appeal.

In the coming ten years, given adequate funding, the Forest Service should be able to plan and conduct various forms of restorative treatments on about 200,000 acres in and around the Lakeview Stewardship Unit. Major landscape-scale projects on the drawing board include Deuce in the Paisley District and East Drews in the Lakeview District. A ten-year schedule of planned and potential vegetation management projects is included in this Strategy.

Additional funding from Congress or other sources will likely be necessary to accomplish the forest health restoration treatments, monitoring, and logging equipment upgrades recommended by this long-range strategy. The Collaborative Forest Landscape Restoration Program established by Congress in 2009 could provide a much-needed new source of funding to eliminate at least some of the budget shortfall. Working with the BLM when administrative lines bisect watershed boundaries will add opportunities to manage larger landscapes in a more holistic manner and may help leverage funding.

The Lakeview Stewardship Group welcomes all feedback on this collaborative strategy and intends to update, expand, and improve the strategy as more and better information becomes available. We consider the strategy to be an important step towards achieving the collaborative vision and goals of the Lakeview Federal Stewardship Unit.



introduction

I. INTRODUCTION

The Lakeview Federal Stewardship Unit within the Fremont National Forest (now Fremont-Winema National Forests) was originally established in 1950 as the Lakeview Federal Sustained Yield Unit for the purpose of enhancing the economic stability of the communities of Lakeview and Paisley in Lake County, Oregon. In 2001, the Chief of the Forest Service re-authorized the Unit with a revised policy statement that established a new name for the Unit, a common vision and a set of new goals and objectives that were developed by the Lakeview Stewardship Group and adopted by the US Forest Service.

> ***Lakeview Federal Stewardship Unit Vision: We envision a sustainable forest ecosystem that, through a new understanding of the interrelationships between the people and the land, will ensure quality of life for present and future generations.***

The Goals of the Stewardship Unit are as follows:

- Sustain and restore a healthy, diverse, and resilient forest ecosystem that can accommodate human and natural disturbances.
- Sustain and restore the land's capacity to absorb, store, and distribute quality water.
- Provide opportunities for people to realize their material, spiritual, and recreational values and relationships with the forest.

The goals and objectives of the Unit are addressed in the Key Issues section of this strategy and are set out in Appendix A.

In order to help achieve these goals, the Lakeview Stewardship Group has developed this long-range strategy as guidance to the Forest Service and others involved in managing the Unit. We view this long-range strategy as part of a unique, collaborative effort to help restore the ecological health of the 500,000-acre Stewardship Unit and to provide economic and social benefits for the local community. The Lakeview Stewardship Group includes conservationists, timber workers, forest managers, local government officials, and other civic leaders. Forest Service and BLM managers are regularly invited to participate with the Group.

The strategy is intended to provide an overall management framework for the Unit as well as help identify funding needs and prioritize areas for active restoration. The strategy should also make it easier for the Forest Service to revise its land and resource management plan for the Fremont-Winema National Forests in the next few years.

In 2009, the Group decided to update the strategy in order to take advantage of the funding opportunities provided by the Forest Service's new Collaborative Forest Landscape Restoration Program. A proposal for CFLRP funding must be based on a "landscape restoration strategy" that:

- identifies and prioritizes ecological restoration treatments for at least a 10-year period;
- encompasses a landscape that is at least 50,000 acres in size and is comprised primarily of National Forest System (NFS) forest lands;
- involves active ecosystem restoration in support of the purposes of the Forest Landscape Restoration Act of 2009;
- includes ecological restoration treatments that will contribute by-products to existing or proposed wood-processing and/or biomass processing infrastructure;
- incorporates the best available science and application tools;

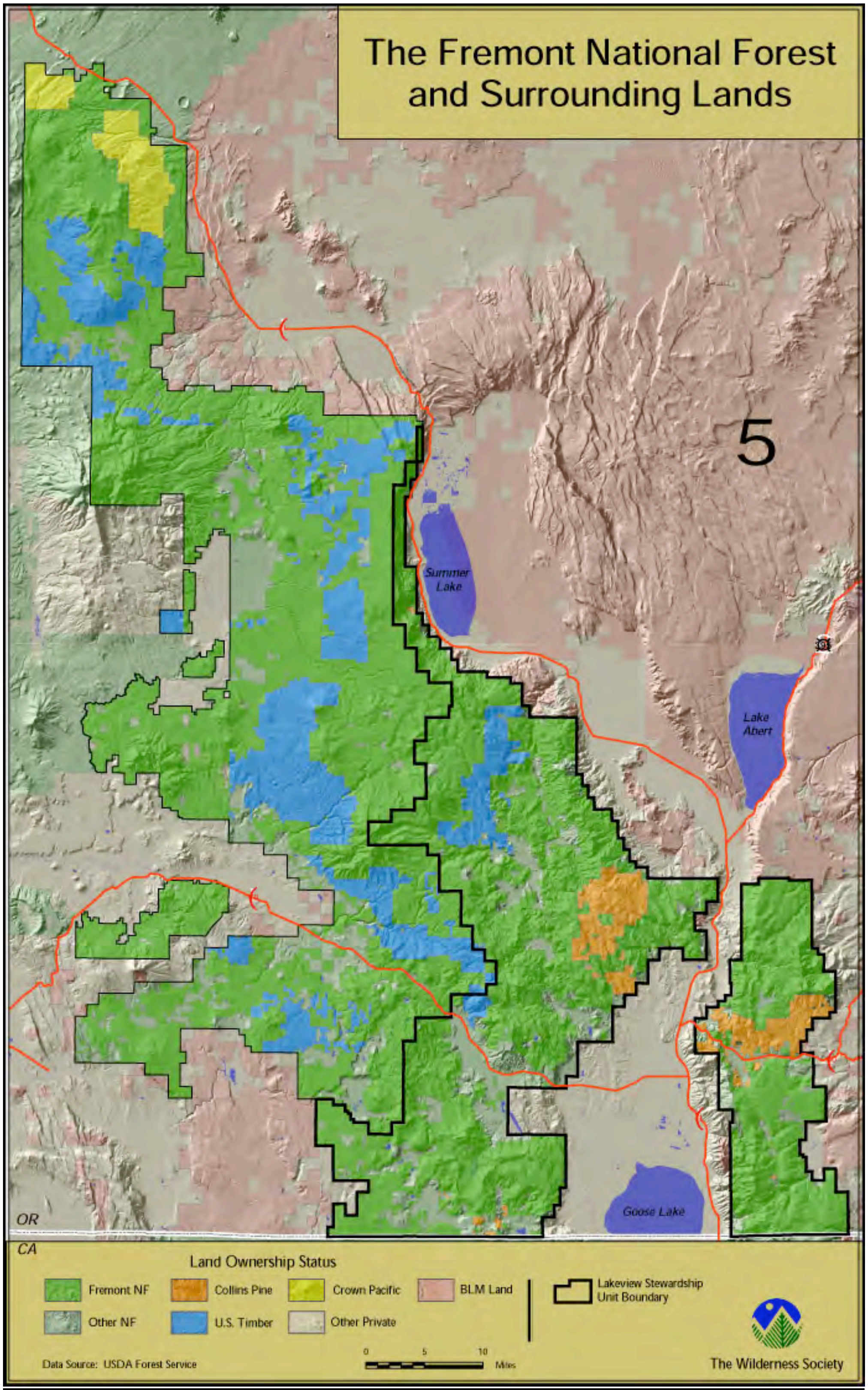
- maximizes retention of large trees and fully maintains, or contributes to the restoration of pre-suppression old growth conditions;
- modifies fire behavior by focusing on the removal of smaller diameter trees in thinnings, strategic fuel break construction and maintenance, and fire use;
- does not involve the establishment of permanent roads to carry out the strategy; and,
- includes funding provisions to decommission all temporary roads constructed to carry out the strategy.

This updated strategy for the Lakeview Federal Stewardship Unit builds on numerous scientific assessments and planning efforts by the Forest Service and independent experts. These past assessments and plans range in scale from the regional Interior Columbia Basin Ecosystem Management Project to several watershed analyses and transportation plans within the Unit completed by the Fremont-Winema National Forests in recent years. The long-range strategy also incorporates elements of the Klamath Tribes' forest management plan developed by the Klamath Tribes for their former reservation land that is managed by the Fremont-Winema National Forests.

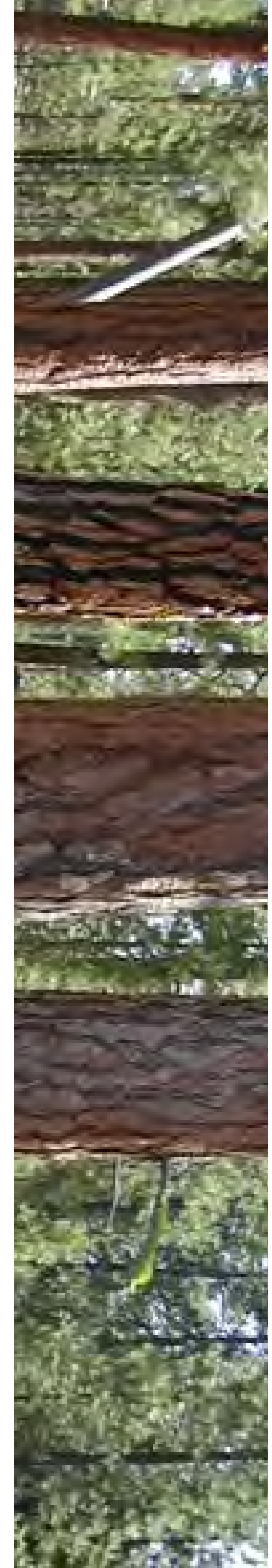
We will continue to update, expand, and improve this strategy as more and better information becomes available and can be incorporated. An "adaptive management" planning approach is especially appropriate and feasible here because of the Chewaucan Biophysical Monitoring Project. Beginning in 2002, this monitoring effort has been gathering a great deal of data about the trees, plants, wildlife, insects, soils, streams, and other ecosystem elements within a large part of the Stewardship Unit. The detailed monitoring information about site-specific ecological conditions and trends supplement the data that were used in the initial strategy.

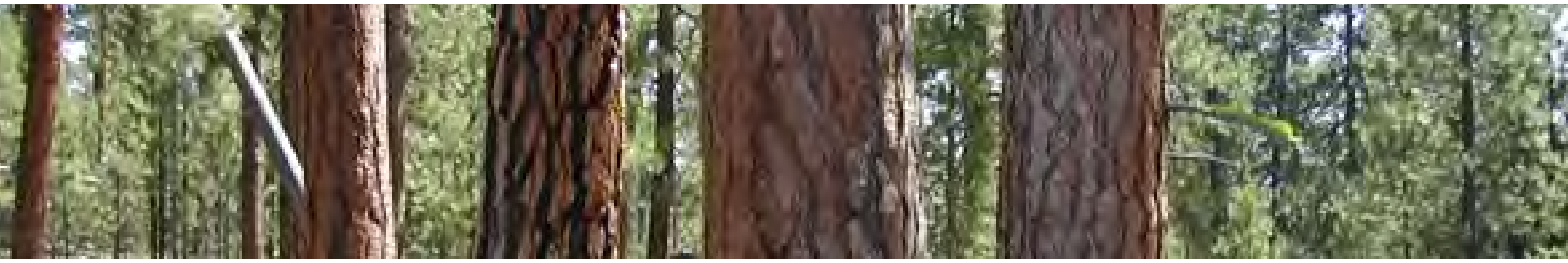
This long-range strategy begins with an overview of how to approach restoration in the context of eastern Oregon and the Lakeview Federal Stewardship Unit. Next, it reviews past studies and existing data relevant to planning for the Unit. The strategy then focuses on eight main issues: (1) forest and rangeland health, (2) soils and water, (3) fish and wildlife, (4) roads, (5) roadless areas and wilderness, (6) recreation, (7) community benefits, and (8) implementation and economics. Finally, the strategy presents a ten-year schedule of management activities, along with a proposed budget.

The Lakeview Stewardship Group appreciates the assistance of the Forest Service in developing and updating this long-range strategy. Several staff members of the Fremont-Winema National Forests generously provided information that we requested, reviewed drafts, and participated in the Group's discussions about the strategy. The purpose of the long-range strategy is to provide collaborative input to help the Forest Service achieve the goals of the Lakeview Unit. The update is also intended to provide a strong scientific, social, and economic foundation for a proposal to the agency's Collaborative Forest Landscape Restoration Program. The long-range strategy does not affect the standards and guidelines, management area prescriptions, or other components of the Fremont land and resource management plan, but strives to contribute information and knowledge of current science.


The Fremont National Forest and Surrounding Lands
5
Summer Lake
Lake Abert
Goose Lake
OR
CA
Land Ownership Status
Fremont NF
Collins Pine
Crown Pacific
BLM Land
Other NF
U.S. Timber
Other Private
Lakeview Stewardship Unit Boundary
Data Source: USDA Forest Service
0
5
10
Miles
The Wilderness Society

Restoration Planning Overview





Restoration Planning Overview

II. RESTORATION PLANNING OVERVIEW

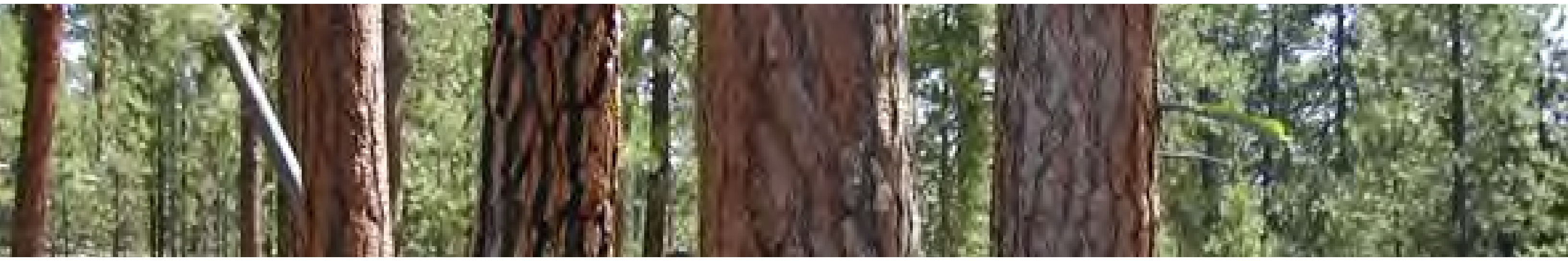
In developing this long-range strategy, the Lakeview Stewardship Group attempted to take a scientifically sound approach. During the past 15 years, scientists from numerous government agencies, universities, and non-governmental organizations have examined environmental and social conditions within and around the Lakeview Federal Stewardship Unit. Many studies have focused on the need to restore the ecological health of forests, rangelands, watersheds, and fish and wildlife habitats. As discussed in Section III, much of the information produced by these studies is relevant to the Unit and useful for this long-range strategy.

Our overall planning effort generally follows the strategic approach presented by Rick Brown in a report, *Thinning, Fire and Forest Restoration: A Science-Based Approach for National Forests in the Interior Northwest* (Defenders of Wildlife 2000). Rick Brown is a long-time member of the Lakeview Stewardship Group and a senior resource specialist for Defenders of Wildlife. In his report, Brown suggests that active forest restoration efforts that reflect the following guidelines will be most likely to succeed:

- Be part of comprehensive ecosystem and watershed restoration that addresses roads, livestock grazing, invasive exotic species, off-road vehicles, etc.;
- Consider landscape context, including watershed condition and both populations and habitats of fish and wildlife;
- Address causes of degradation, not just symptoms;
- Provide timber only as a by-product of primary restoration objectives;
- Avoid construction of new roads;
- Be based on local assessment of pre-settlement conditions;
- Take place in dry forest types;
- Use fire as a restoration treatment, either alone or following thinning;
- Treat thinning slash and other surface fuels (preferably with fire);
- Retain all large, old (presettlement) trees and large snags, and provide for their replacement over time;
- Have negligible adverse effects on soils;
- Address other vegetation in addition to trees, including noxious weeds;
- Incorporate monitoring as an essential element and cost of the project;
- Learn from monitoring and adapt management accordingly.

These guidelines continue to provide a scientifically sound basis for restoration management in the Lakeview Unit and many other areas of the Interior Northwest.

In 2009, Dr. Norm Johnson from Oregon State University and Dr. Jerry Franklin from University of Washington issued a paper on forest management in the Pacific Northwest that is directly relevant to the Lakeview Unit. The information and recommendations in this paper have been carefully considered in updating the long-range strategy.



Relevant Studies and Existing Data

III. RELEVANT STUDIES AND EXISTING DATA

A. Regional Context: Interior Columbia Basin Assessment (ICBEMP)

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) was a massive interagency scientific study that included all of eastern Oregon and the interior Columbia River Basin. The ICBEMP examined changes in the terrestrial and aquatic ecosystems that have occurred throughout the Basin since European settlement. Areas that had changed markedly were considered to have lower ecological integrity than areas that had not changed much. The Fremont National Forest, BLM Lakeview District, and LFSU were considered as part of a cluster of forests that have low forest integrity and low or moderate aquatic integrity. The area is dominated by dry forests that are extensively roaded and have little, if any, Wilderness. Forest structure and composition have been substantially altered from historical conditions. These forests show large changes in fire frequency but less change in fire severity. (Status of the Interior Columbia Basin: Summary of Scientific Findings, PNW-GTR-385, p. 122)

The ICBEMP study also found that the amount of forest in the Basin with “lethal” fire regimes has more than doubled, posing a significant risk to ecological integrity, water quality, species recovery, and homes in rural areas. Drought, fire suppression, overgrazing, and logging have contributed to significant changes in forest and range landscapes. Native grasslands and shrublands have declined and noxious weeds are spreading rapidly. Uniform stands of middle-aged trees have replaced old and mixed age stands, and much more of the timber volume consists of small-diameter trees. (Highlighted Scientific Findings of the Interior Columbia Basin Ecosystem Management Project, PNW-GTR-404, p. 13-14)

Based on the ICBEMP study, the Forest Service and BLM recommended a management alternative that aggressively restores ecosystem health through active management using an integrated ecosystem management approach. However, the agencies did not make a final decision on the ICBEMP plan and instead adopted a strategy in 2003 to incorporate the science data into local forest plans and projects. (The Interior Columbia Basin Strategy, www.icbemp.org).

Johnson and Franklin

Dr. Norm Johnson and Dr. Jerry Franklin have extensively studied forest conditions in the Fremont-Winema National Forest and elsewhere in the region and have proposed authoritative restoration strategies. In 2008 they completed a detailed forest restoration plan for the Klamath Tribe’s former reservation land in the Fremont-Winema. (Norman K. Johnson, Jerry F. Franklin, Deborah Johnson, “A Plan for the Klamath Tribes’ Management of the Klamath Forest,” May 2008, http://www.klamathtribes.org/information/background/documents/Klamath_Plan_Final_May_2008.pdf).

The following year they produced an influential forest management proposal for both dry and moist Pacific Northwest forests. (Johnson and Franklin, “Restoration of federal forests in the Pacific Northwest: Strategies and management implications,” 2009). Johnson and Franklin recommend active restoration management of the dry forest types, including both ponderosa pine and mixed conifer stands. They suggest treating approximately two-thirds of the forests within a landscape to restore ecological integrity.

B. Local Studies

Third Party Review

In 1999, at the request of Sustainable Northwest and Lake County, a consulting team of four scientists and management specialists conducted a study of the LFSU. (Wayne Elmore, Robert Hrubes, Chris Maser, Walter Smith, “A Third Party Review of the Lakeview Federal Sustained Yield Unit,” March 1999). While admittedly not an in-depth analysis of ecological conditions within the Unit, the review was informed by the results of several site-specific watershed analyses that the Fremont National Forest completed between 1995 and 1998. The consultants found considerable ecological alteration and degradation due to past management emphasis and practices, along with significant restoration and stand-improvement needs. More specifically, the team concluded that past practices had resulted in:

- loss of habitat diversity leading toward management-created homogeneity across the landscape as a whole;
- soil compaction;
- high road densities;
- loss of mature forest structure;
- increased density and risk of fire;
- species conversion from Pine-associated to Fir-associated forest types;
- loss of habitat for threatened and endangered species; and
- lack of a comprehensive monitoring system.

Watershed Analyses

As noted above, the Forest Service and BLM completed several site-specific watershed analyses covering large portions of the LFSU – including the Upper and Lower Chewaucan River, Deep Creek, and Thomas Creek during the late 1990s. The watershed analyses identify issues, describe current and historical (reference) conditions, synthesize and interpret data, and make recommendations for management. This long-range strategy relies significantly on the resource information and recommendations contained in the watershed analyses.

University of Washington Fire Study

In 2003, the University of Washington’s Rural Technology Center completed a study of fire conditions and potential fuel treatments in the Fremont National Forest. (Mason et al. 2003, Investigation of Alternative Strategies for Design, Layout and Administration of Fuel Removal Projects). Using Continuous Vegetation Survey data collected on 502 plots, the UW study calculated proportions of the Fremont with high, moderate, and low levels of fire risk. The UW study also used computer models to evaluate the effectiveness of various types of fuel treatments in reducing fire risk. Results of this study are presented in the Fuels and Fire section below.

Nature Conservancy Fire Learning Network

Conducted in 2007-2009, the goal of this project was to develop scientifically sound and socially acceptable solutions to the problem of altered fire regimes and degraded forest health. These were key issues identified in the *Oregon Conservation Strategy*. The project has produced a collaboratively developed treatment prioritization map for the 500,000-acre Lakeview Stewardship Unit in Southern Oregon.

Because it is important to understand the ecological trade-offs that occur when management is required to balance many stakeholder preferences, it was of interest to compare and assess the stakeholder-designed priority map with a Treatment Optimization scenario to determine which approach maximizes landscape restoration while simultaneously reducing the threat of uncharacteristic fire. In addition, the assessment provided an up-to-date vegetation assessment for the Lakeview Stewardship Unit. This information can be used to assess the effects of management actions to reduce the threats of wildfire, and to analyze how climate change will influence fire behavior and the effectiveness of the restoration approaches.

The work and products provide a foundation for strategic federal land management decision-making and project selection in the Lakeview Stewardship Unit for the next ten years. Working in cooperation with stakeholders and federal partners, it was possible to prioritize approximately 110,000 acres for active restoration. Treatment of the priority sites will support restoration and conservation of multiple ecosystem services including wildlife habitat. By identifying high-priority places for treatment in a collaborative framework, the Forest Service will have the benefit of knowing locations where there is likely to be public support for management (and therefore potentially less conflict) and where each management dollar spent will yield multiple resource benefits.

An analysis of focal wildlife species habitat was also completed. The analyses identified species representative of each plant community and evaluated the historic and current habitat conditions. Habitat assessments identified species and areas where management would best meet ecological requirements. The focal species assessment was met with enthusiasm by state and federal wildlife biologists, who will use the analysis to help inform forest plan revisions.

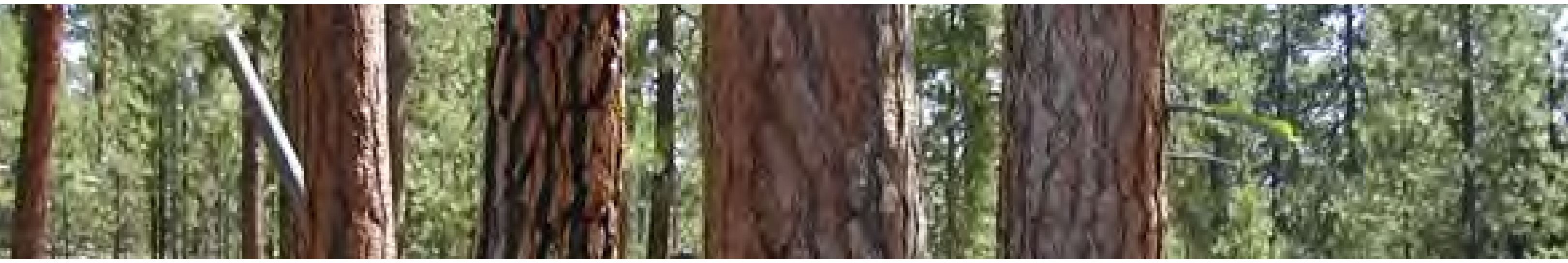
The actions and products facilitated by this analysis create a compelling case for why restoration is needed in ecologically degraded fire-dependent forests. It builds the case for restoration through a habitat analysis conducted for focal species in the Lakeview Stewardship Unit. Through modeling, it was possible to demonstrate that current habitat conditions will favor those species that prefer dense conditions at the cost of those species that require open canopy. Open canopy-dependent species are declining, much to the alarm of wildlife managers, academic scientists, and stakeholders. In addition, their habitat is vulnerable to significant loss due to uncharacteristic fire, insect and disease outbreaks, and the stress induced by climate change.

Biomass Supply Study

In 2005 Catherine Mater of Mater Engineering completed a Coordinated Offering Protocol (CROP) for a 100-mile radius around Lakeview. This analysis covered portions of 3 states, 4 National Forests, 14 Ranger Districts, 8 BLM Districts, 9 counties, State lands and tribal lands. The analysis demonstrated that there was enough volume to support a small diameter sawmill and a biomass energy plant.

In 2007 TSS Consultants analyzed Lakeview's biomass potential for Marubeni Sustainable Energy. The information, while proprietary, was used by Marubeni to develop plans for building a 15 MW plant. In 2009 Iberdrola Renewables purchased the development rights for the Lakeview Biomass project.

In the past two years, monitoring of completed operations under Forest Service Stewardship authorities has improved the understanding of volume per acre that could be expected under the new 10-year Stewardship Contract. Greater knowledge of actual volumes, more efficient biomass technology, and additional acres from Jen-Weld Timber Resource lands and lands south into California showed that a 25 MW biomass plant would be sustainable for the 20-25 year life of a biomass plant.



Key Issues

IV. KEY ISSUES

A. Forest and Rangeland Health

Goal: Sustain and restore a healthy, diverse, and resilient forest ecosystem that can accommodate human and natural disturbances.

1. Fuels and Fire

Objectives:
- *Restore stand-maintenance fire regimes.*
- *Restore forest conditions that approximate historical species composition and stand ages.*

The major tree species in the Fremont National Forest are ponderosa pine, juniper, lodgepole pine, and at higher elevations white fir. Most of these trees are adapted to summer drought and extreme temperature fluctuations due to the nature of the arid region. Annual precipitation is 10-20 inches from autumn through spring, and summers are hot and dry. (Mason et al., p. 17.)

Historically, the ponderosa pine forests were maintained by relatively frequent, low-severity surface fires. Lodgepole pine forests were maintained by infrequent, intense insect attack followed by high-severity stand-replacing fire. In mixed conifer and white fir stands, fire and insect disturbances were variable in frequency and intensity, resulting in a wide range of conditions. (Upper Chewaucan Watershed Analysis (WA), p. RC-4 & 5)

Ponderosa pine stands were typically park-like with large, well-spaced trees and sparse shrubs and down wood, maintained by frequent light surface fires at 1-25 year intervals. Ponderosa pine dominated below 6,000 feet and on south-west slopes above 6,000 feet. Mixed conifer stands were "jumbled up" with complex structure and severe fire return intervals of 25-300 years. (Lower Chewaucan WA, p. RC-4 & 5)

Lake County Resources Initiative has collected data on the number and acreage of wild fires that burned within and adjacent to the Unit for the past 25 years. Notably, in the first decade the fires averaged about 430 acres, but between 1995 and 2005 the average exceeded 6,000 acres. Over the 25-year period, most of the acreage burned in 2002 due to the large Grizzly, Toolbox, and Winter Rim fires. Even omitting the 2002 fires, average acreage in the past decade exceeds 1500 acres, triple the previous decade.

The Klamath Tribes' Forest Plan contains some useful historical data about forest conditions in Lake County prior to widespread logging and fire suppression. These data suggest that ponderosa pine stands generally contained about 15 trees/acre larger than 20 inches in diameter and about 40 trees/acre between 20 and 4 inches in diameter. The Chewaucan Biophysical Monitoring Project is also providing useful data on local reference conditions.

As in many other eastside forests, years of fire suppression, extensive high-grading of the dominant ponderosa pine overstory, and extensive livestock grazing have resulted in many acres of the Fremont being increasingly converted to a forest that is dominated by white fir. Forest stands dominated by white fir are more susceptible to drought stress and associated outbreaks of insects and disease, increasing the risk of large-scale wildfires. (Elmore et al., p. 16 & 17).

With fire exclusion, formerly single-storied, park-like ponderosa pine stands are becoming increasingly multi-storied. The practice of high grading has left many stands with a large stagnant component of white fir that normally would have been absent historically. Current stand density is higher than the historical level in many areas of the forest. White fir and mixed conifer stands have high densities that place them at risk of disease, insect attack, and density-related mortality. (Deep Creek WA, p. CC-11; Lower Chewaucan WA, p. CC-8)

The University of Washington study of high severity fire risk on the Fremont National Forest found that 31% of the forest was at high risk, 47% moderate risk, and 22% low risk. The dominant tree species in high risk stands are 53% white fir, 25% ponderosa pine, and 21% lodgepole pine. Low risk stands are 73% ponderosa pine and 21% lodgepole. The study found that thinning to remove one-half of the basal area would result in shifting the high-risk stands to 66% moderate risk and 27% low risk, while thinning to leave 45 sq. ft. of basal area per acre would change the high-risk stands to 27% moderate risk and 71% low risk. However, under any treatment scenario, nearly all stands would return to high risk within 15-20 years unless there was follow-up treatment. (Mason et al.)

The Forest Service has been underburning ponderosa pine stands since the 1970s. Very little underburning has occurred in mixed conifer forests. (Lower Chewaucan WA, p. CC-11). During the past decade, the Forest Service has been thinning ponderosa pine stands to remove the white fir understory and reduce overall stand density.

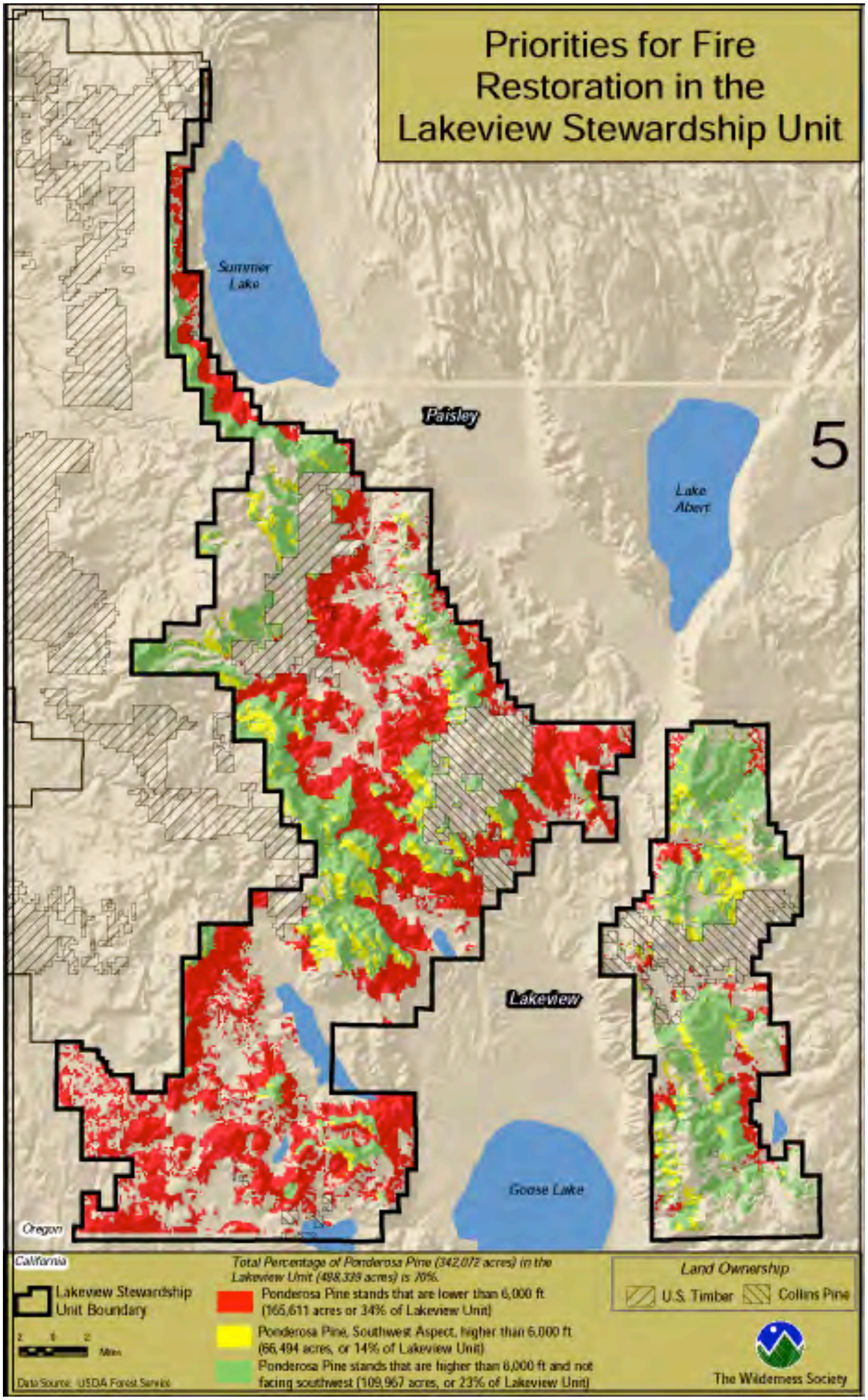
KEY VEGETATIVE TREATMENT ACTIVITIES IN LAKEVIEW FEDERAL STEWARDSHIP UNITY, 2001-2009

Year	Commercial Treatment Acres	Non-Commercial Fuel Reduction Acres	Prescribed Burning Acres
2001	3,647	2,872	3,750
2002	1,048	2,708	4,000
2003	2,833	1,343	9,187
2004	5,626	4,453	10,487
2005	507	5,357	0
2006	1,783	5,302	9,864
2007	3,562	4,614	12,178
2008	5,712	3,209	167
2009	2,203	5,927	0
Totals	**26,921**	**35,785**	**49,633**

These data need some interpretation and explanation. First, the commercial treatment numbers include both commercially-driven post-fire salvage logging of large dead trees and ecologically-driven “green” commercial thinning of generally small diameter trees. For the years 2001-2005, the acres of commercial treatment primarily consisted of fire salvage treatments, whereas since 2006 commercial treatments have focused on green tree thinning. Second, the annual prescribed burn numbers fluctuate widely because the Forest Service’s burn program focused on areas within the Unit in some years and moved to other parts of the Forest in other years. The large burns have generally occurred in relatively open forest lands, where per-acre costs are low compared to the more heavily forested lands that require substantial thinning and other treatment before they can be burned.

2005 Analysis of Potential Restoration Treatment Areas

For the 2005 Long-Range Strategy, The Wilderness Society conducted a GIS analysis of forest vegetation within the Unit to determine the approximate amount and location of areas that have relatively frequent fire return intervals and potentially would benefit from restoration treatment. Specifically, the analysis identified stands that are in the ponderosa pine ecotype, are located below 6,000 feet in elevation, and are located above 6,000 feet on southwest-facing slopes. As indicated in the table below, the analysis found that about 342,000 acres, or 70 percent of the Unit, are ponderosa pine stands. Of these, about 232,000 acres, or 48 percent of the Unit, are below 6,000 feet elevation or at higher elevations on southwest-facing aspect.


Priorities for Fire Restoration in the Lakeview Stewardship Unit
Summer Lake
Paisley
5
Lake Abert
Lakeview
Goose Lake
Oregon
California
Lakeview Stewardship Unit Boundary
Miles
Data Source: USDA Forest Service
Total Percentage of Ponderosa Pine (342,072 acres) in the Lakeview Unit (498,339 acres) is 70%.
Ponderosa Pine stands that are lower than 6,000 ft (165,611 acres or 34% of Lakeview Unit)
Ponderosa Pine, Southwest Aspect, higher than 6,000 ft (66,494 acres, or 14% of Lakeview Unit)
Ponderosa Pine stands that are higher than 6,000 ft and not facing southwest (109,967 acres, or 23% of Lakeview Unit)
Land Ownership
U.S. Timber
Collins Pine
The Wilderness Society

ACREAGE OF PONDEROSA PINE ECOCLASS ABOVE AND BELOW 6,000 FEET ELEVATION AND ON SOUTHWEST ASPECT

Total LFSU Acreage	488,339 acres
Total Ponderosa pine Ecotype	342,072 acres
Low Elevation Ponderosa pine (<6,000 ft)	165,611 acres
High Elevation Ponderosa pine (>6,000 ft)	176,461 acres
High Elevation Ponderosa pine on SW Facing Aspects	66,494 acres
Low Elevation PPine and SW Aspect High Elevation PPine	232,105 acres

TNC Assessment of Values Mapping

This 2010 Long-Range Strategy has utilized The Nature Conservancy's (TNC) state-of-the-art Fire Learning Network to help identify the highest priority areas for restoration treatments. The goal was to develop a practical adaption planning process to guide selection and integration of forest management recommendations into existing policies and programs. This process aimed to facilitate restoration treatments across a broad geography and engage the Forest Service and Lakeview Stewardship Group (LSG) in conservation action at scale. Benefits of this approach are in evaluation of the effectiveness of alternative restoration treatments using an active adaptive management approach.

Collaboratively derived forest restoration prescriptions are the result of negotiations that attempt to balance values, ideology, and ecology. Although policy makers, land managers and stakeholders all agree that management action should be based on the best available science, this good intent rapidly erodes without site specific information on the historic conditions from which to ground truth and compare proposed treatments.

The process of building trust in management decisions is with scientifically defensible methods and transparency. Federal land managers and stakeholders need site-specific data on historic stand structure, fire-return intervals, and species composition as a starting point for prescription design. These data create a picture of the last time forests were resilient, where the full complement of biodiversity was present and the entire ecosystem was in dynamic balance with landscape processes and function. Without this information there is no ability to evaluate the effectiveness of management actions for meeting ecological goals. In addition, stakeholders and managers need this data to evaluate how proposed variation from historic site conditions (based on ideology or values) will affect long-term ecological sustainability at the site.

Providing baseline data on historical stand structure, fire return intervals, site potential, and current forest conditions is essential to monitor the effectiveness of forest treatments. It may be the best strategy in our adaption management arsenal to assess forest health with climate change. Current predictions are that the climate will be warmer in areas of the Pacific Northwest. Recent research shows that fire seasons are already lengthening and fire duration is increasing (Westerling[1], et.al. 2006). Reducing fuel loads and focusing on building resiliency in old trees that have the genetic code for surviving long periods of drought in the past is urgently needed in the face of rapidly changing conditions.

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[1] Westerling, A.L., H. G. Hidalgo, D. R. Cayan, and T. W. Swetnam. 2006. "Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. Science. V 313: pp.940-943. www.sciencemag.org

Consistent with the Forest Service's new approach to forest management through collaboration and managing for a full suite of ecosystem benefits (Vilsack[2], 2009), this analysis demonstrates how collaborative efforts can accelerate restoration of fire-adapted forests on federal lands at meaningful scales. Results of this effort have: 1) increased capacity with landscape assessments to prioritize restoration; 2) provided ecological data to ground truth and monitor management effectiveness; 3) added implementation capacity to restoration areas; and 4) developed an active adaptive management approach to evaluate the success of restoration treatments.

Objectives. Using a "nominal group technique," the LSG engaged in identifying, prioritizing, and weighting the places they felt need restoration action. The process was bounded by the realities of the land management agencies, data types, and the timeframe under which the data can maintain relevance to the federal agencies. The LSG identified eleven values which included: Mule deer winter range, Invasive species, Forested Ecosystems within Natural Range of Variability, Old Growth, Critical Infrastructure, Private lands buffer, Rare and sensitive plants, Recreation areas, Riparian Areas, Water Quality, and Wildland Urban Interface areas. The values assessment narrowed the final list to Forested Ecosystems within the Natural Range of Variability and Old Growth.

Forest Ecosystems within the Natural Range of Variability (NRV) were assessed as forests that are in mid- to late-succession with frequent fire regimes. The assessment was based on USFS Regional 6 Plant Association Guide (PAG) (Table 2) and LANDFIRE (Structural and FRCC) data. TNC used the FRCC data for Fire regime 1 and Condition Class 3 with mid-successional closed canopy stands. Through the assessment 200,000 acres were identified where treatments would restore NRV.

Treatable Stands. Treatable Stands are identified as Frequent Fire Stands that are highly departed and are over-abundant in a Closed Canopy state. In the initial analysis TNC used the PAG in our classification of Frequent Fire Systems. The analysis required using an updated PAG layer that was also correlated to current conditions. This data was then used to develop the Restoration Priority Scenario. Treatable Stands/Restoration Priority Areas data is the result of the LSG values assessment. We provide this information here to disclose the criteria and process used in the treatment prioritization classification knowing that there will be updates in data and methods, which will ultimately change the acres where treatment will occur.

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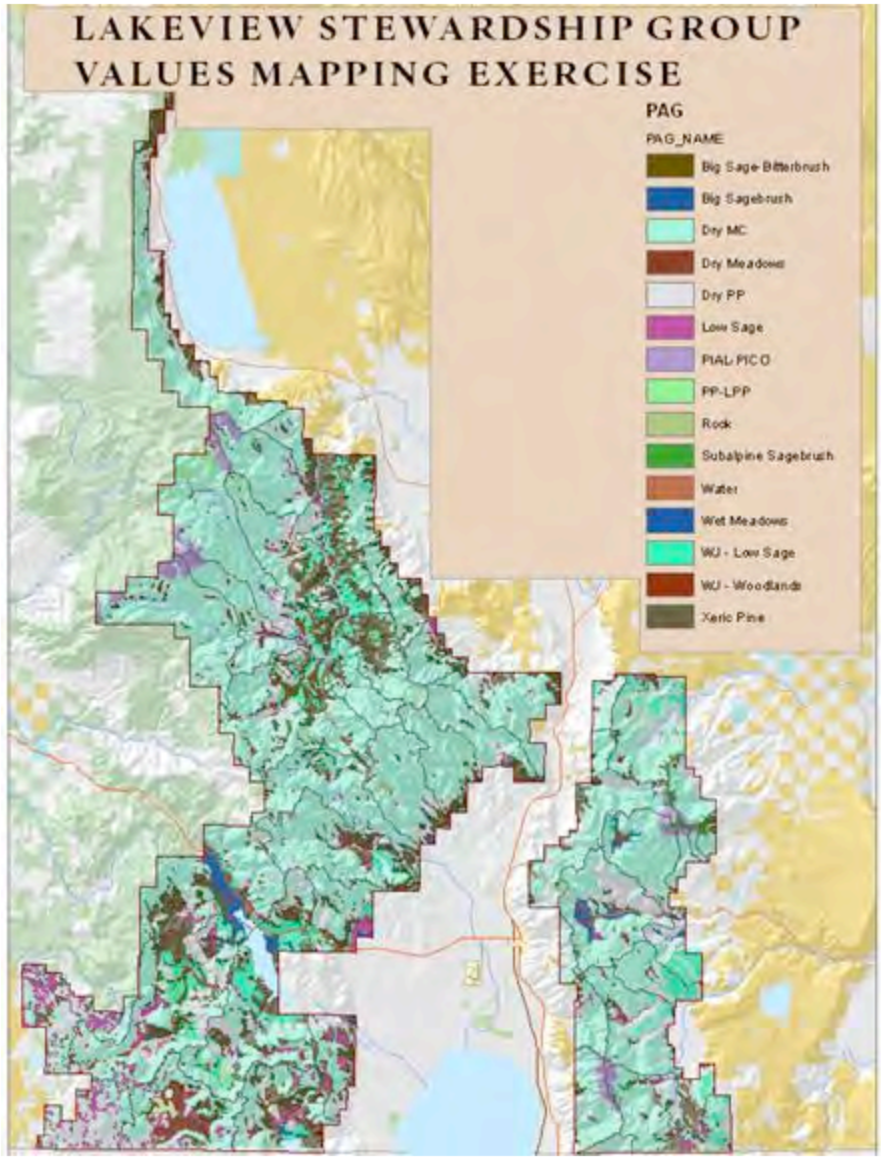
[2] Vilsack, T.2009. AGRICULTURE SECRETARY VILSACK ANNOUNCES NEW DIRECTION AND VISION FOR AMERICA'S FORESTS. August 14, 2009. Seattle, Washington.
http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB?contentidonly=true&contentid=2009/08/0383.xml


LAKEVIEW STEWARDSHIP GROUP
VALUES MAPPING EXERCISE
PAG
PAG_NAME
Big Sage-Bitterbrush
Big Sagebrush
Dry MC
Dry Meadows
Dry PP
Low Sage
PIAL-PICO
PP-LPP
Rock
Subalpine Sagebrush
Water
Wet Meadows
WJ - Low Sage
WJ - Woodlands
Xeric Pine

REGION 6 PLANT ASSOCIATION GUIDE DATA FOR THE LAKEVIEW STEWARDSHIP UNIT

Plant Associations	Total		Federal	Non-Federal
Total acres in LSU	662,289	Frequent	487,923	174,366
Non-Forested		Fire		
Big Sage/bitterbrush	6,727		2,248	4,479
Big sage	2,000		12	1,988
Dry meadows	15,472		6,279	9,193
Low sage	19,223		15,733	3,490
Wet meadow	8,242		1,180	7,062
Juniper / Low sage	37,187		21,705	15,482
Woodlands/juniper	1,670		826	844
Sub-alpine sage	2,336		2,148	188
TOTAL	**90,521**		**47,983**	**42,538**
Percentage	0.14		0.10	0.24
Rock	2,146		1,875	271
Water	3,547		840	2,707
Forested				
Dry mixed Con	381,395	381,395	294,691	86,704
Dry Ponderosa Pine	75,667	75,667	55,381	20,286
PIAL/PICO	10,563		9,855	708
PP/LPP	3,023	3,023	2,935	88
Xeric pine	93,091	93,091	72,215	20,876
TOTAL	**563,739**	**553,176**	**435,077**	**128,662**
Percentage	0.85	0.84	0.89	0.74

Climate Change is expected to change the intensity and magnitude of fire behavior. Most climate models for south central Oregon identify hotter and dryer conditions. TNC conducted a sensitivity analysis by increasing temperature 5 degrees and dropping humidity 5%. The results suggest that there may be slight difference in fire behavior (flame length changed in the highest category 7% and Crown Fire Activity Changed 18%). Additionally, we may need to change the previous two fire behavior metrics to include the factor of *contagion*. Fire is a contagious process. As we model fire behavior we can see that everywhere we treated the hazard dropped significantly. But, the cumulative benefit of treatments may not be accurately reflected through the fire modeling.

Modeling Forest Management to Reduce Fuel Loads and Restore Natural Stand Conditions

The 2005 Long-Range Strategy used Landscape Management System (LMS) to predict changes in stand conditions under one set of possible management options, modeling an approach similar in some respects to that proposed in the Klamath Tribes' draft forest plan. The model demonstrated that, on average, open stands dominated by trees generally 21 inches in diameter or larger can be created in 30 to 50 years for the ponderosa pine and mixed conifer habitat types, significantly reducing the risk of crown fire and allowing the forests to sequester and store carbon. The modeling also suggested that restrictions on cutting trees larger than 21 inches in diameter should be relaxed in 30 to 40 years to allow maintenance of desired stocking levels and stand characteristics. Surveys by the Chewaucan Biophysical Monitoring Team from 2006-2009 indicate that many stands are currently stocked with trees larger than 21 inches.

Some of the simplifications necessary to conduct this modeling include thinning to basal areas at or below the lower range suggested in the Klamath Tribes' plan and reaching the target basal area in the first thinning, rather than through successive entries. The model was also used to achieve open stands in moist mixed-conifer habitat types where complex, multi-species, multi-layered stands were probably common historically. Refining these models to more closely reflect anticipated on-the-ground management is an ongoing process.

Mountain Pine Beetle

Mountain pine beetles are currently ravaging the Upper Chewaucan watershed, infecting more than 300,000 acres in and around the Unit. Data gathered by the Chewaucan Biophysical Monitoring Team from 2007-2009 indicates that there is almost 100 percent mortality in all lodgepole pine larger than 12 inches in diameter and almost no mortality in trees smaller than 4 inches in diameter. Even though the big trees are dead, about 60 percent of the original stand is unaffected, leaving stands stocked with trees from 30 to 50 feet tall that become visible as the red needles fall off the large dead trees. There are several stands with unaffected big lodgepole pine in which the stocking levels of the large trees were at 35 basal area, though the stand had a basal area greater than 200. This hints at a management plan that limits the basal area of large lodgepole pine. More surveys need to be conducted to determine the significance of this finding. For more details, see www.lcri.org/monitoring/reports/Beetle Kill in the Upper Chewaucan.

These areas appear to be at high risk for catastrophic stand-replacing fires. As the large trees fall in the next few years (many large trees fell during 2009), the soils may be at risk of undesirable adverse effects of fire. This issue is discussed further in www.lcri.org/monitoring/reports/Potential Effect of Catastrophic Fires on Mazama Ash Soils in the Upper Chewaucan Red Zone.

The current outbreak of mountain pine beetle in south-central Oregon has led forest managers to consider thinning as a means of decreasing residual tree susceptibility to attack and subsequent mortality. Previous research indicates that susceptibility of lodgepole pine, to mountain pine beetle is a function of a tree's physiological vigor and the intensity of attack. Trees able to produce ≥80 g (g) of wood per m^2 of projected leaf area annually are highly resistant, because they are able to shift resource allocation locally from wood to resin production to isolate blue-stain fungi introduced by attacking beetles. Typically, the leaf area of susceptible stands must be reduced by two-thirds to permit most residual trees to increase their vigor to a safe level.

Generally, outbreaks of mountain pine beetle are more likely to occur in lodgepole pine stands with trees older than 60 years and larger than 25 cm in diameter (Cole & Amman, 1969; Amman, 1978; Wellner, 1978). Larger diameter trees have thicker bark, which facilitates the construction of egg galleries, provides better protection from natural predators, and insulates against external temperature extremes and desiccation (Safranyik& Carroll, 2006). In addition, there is a positive relationship between tree diameter and phloem thickness (Amman, 1969; Shrimpton & Thomson, 1985), with the phloem being the primary nutrient source for the beetles and their larvae (Amman, 1972; Amman & Pace, 1976; Berryman,1976; Klein et al.,1978). Thicker phloem results in larger broods, larger beetles, and enhanced survival rates (Safranyik & Carroll, 2006); however, phloem thickness is not directly related to a tree's ability to resist beetle attack (Shepherd, 1966). Large diameter trees appear more susceptible when their growth becomes reduced — either temporarily, through an event such as severe drought, or permanently, as a result of disease or mechanical damage.

There is debate over whether thinning is an effective treatment for managing mountain pine beetle infestations because it increases tree vigor (Mitchell et al., 1983; Waring & Pitman, 1985) or because thinning alters the microclimate (e.g., temperature and wind patterns), producing unfavorable conditions for beetles (Bartos & Amman, 1989; Amman & Logan, 1998). Regardless, increases to tree vigor and alterations to stand microclimate are both known outcomes of thinning treatments (Waring & O'Hara, 2005), and likely play some role in reducing stand susceptibility and subsequent mortality due to mountain pine beetle attack, although perhaps over different time horizons (Amman et al., 1977). In this context, we use vigor as an indicator of stand susceptibility, although we acknowledge the role of microclimate and stand dynamics in determining susceptibility.

In 2009, the Forest Service, in consultation with the Lakeview Stewardship Group, approved a Red Zone Safety Project to improve public and employee safety by removing beetle-killed lodgepole along 200 miles of roads and within 25 recreation sites in and around the Lakeview Unit. Implementation of this project will produce logs and biomass for commercial use as well as create strategic fuel breaks to help control fires.

<u>Fuels and Fire Guidelines:</u>

- Use Fire Learning Network, Landscape Management System, or similar GIS analyses and computer tools to model and inform forest restoration activity in the Unit.
- Undertake an accelerated thinning and prescribed burning program, using the Klamath Tribes' plan as a model, supplemented, as appropriate, by local or more recent information.
- Identify priority areas for treatment, including:
    1. near residences;
    2. adjacent to private forest lands that have approved management plans;
    3. in stands with remnant old-growth ponderosa pine (in ponderosa pine or mixed-conifer plant association groups) where dense younger trees put the stands at risk of uncharacteristically severe fire or drought stress;
    4. in other ponderosa pine and dry mixed-conifer stands with existing road access.
- Base restoration treatment prescriptions on Chewaucan Biophysical Monitoring and other local data about reference conditions, as well as other appropriate data and models.
- Restore more natural fire conditions in appropriate areas and circumstances through prescribed fire, modified suppression tactics, and updated fire management plans.

2. Old Growth

Objective: Restore forest conditions that approximate historical species composition and stand ages.

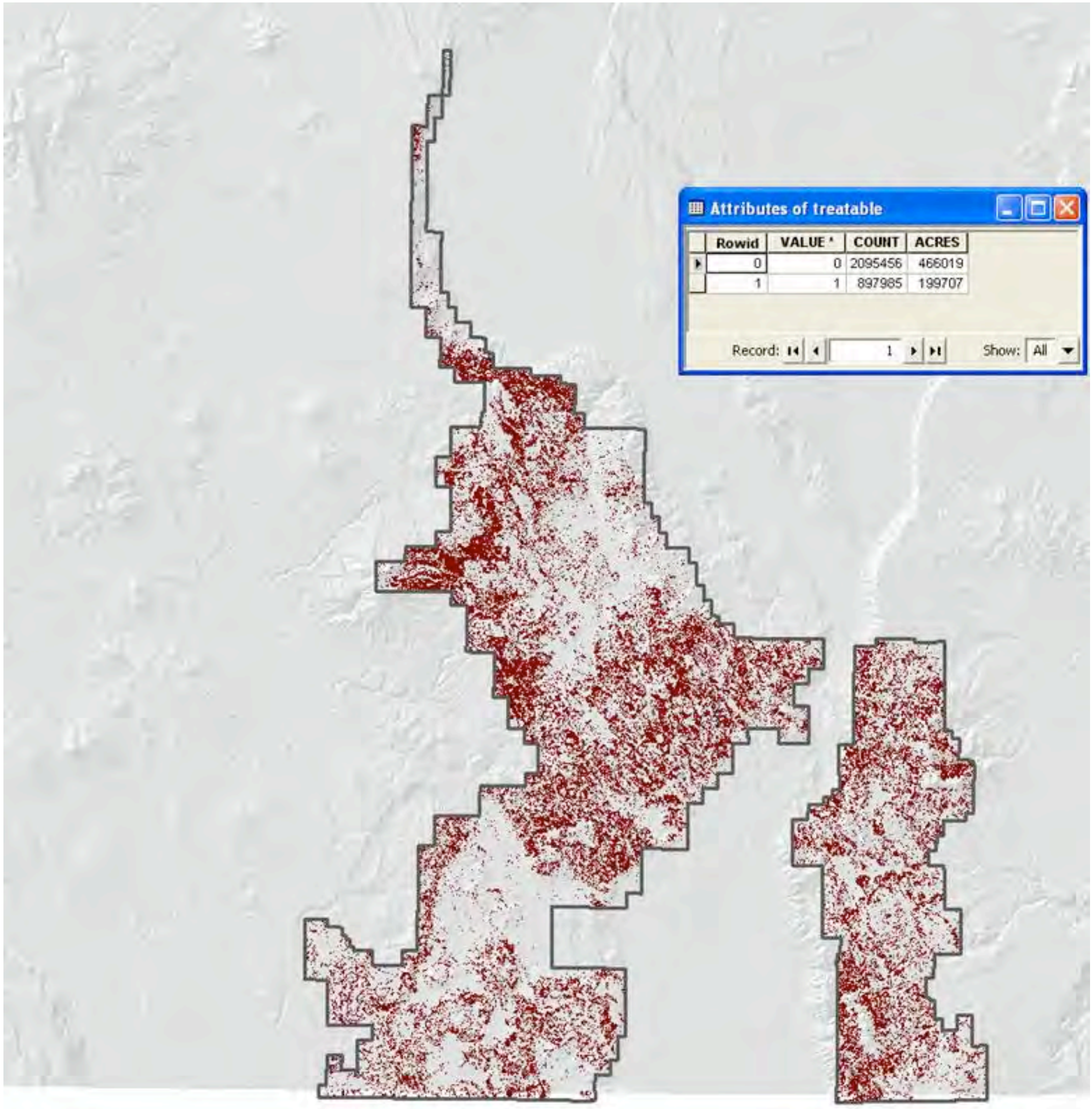
Historic and Current Conditions

Historically, ponderosa pine forests were mostly in large park-like pine stands with occasional small openings; 60-80 percent were in old structural condition. Mixed conifer forests had variable conditions due to infrequent, stand-replacing fires following insect mortality and high fuel loads; 40-70 percent were in old and late structural condition. Lodgepole pine forests had large, even-aged patches due to frequent stand-replacing disturbances; 30-90 percent were in early structural condition. (Upper Chewaucan WA, p. RC-4; Lower Chewaucan WA, p. RC-4). Continuing Forest Service analysis suggests that the old structural condition in ponderosa pine may have been somewhat lower (40-50%) than the estimate in the Chewaucan WA; preliminary national-level documentation can be found at http://www.frcc.gov/docs/reference/WEST_Forest_BpS_01.11.05.pdf.

There are many different definitions for late successional, old, or old growth forest, and most of them center on age, size, and structure. The following table summarizes the attributes from the 1992 Region 6 Green Book definitions for old growth. The vegetation assessment used these definitions. The method to assess existing old growth incorporated Gradient Nearest Neighbor (GNN) data, which was calibrated using Forest Vegetation Simulation (FVS), and Viable. The methods used to assess the number of acres of old growth are in Appendix B.

Factor	Cold Forest	Moist Forest	Dry Forest	Lodgepole Pine cover type
DBH	21	21	21	12
Trees per acre	10	10-20	10	60
Age	150	150	150	120
Variation in Tree Diameter	yes	yes	yes	yes
Tree Decadence	yes	yes	N.A.	N.A.
Tree Canopy Layers		1	1	1
Dead DBH	12	14	14	12
Dead TPA	2	1	3	5
Down Diameter	12	12	-	-
Down Pieces per acre	4	5	0	0

According to this analysis, there are 199,707 acres of old growth on Federal lands in the Lakeview Stewardship Unit. This is equivalent to 46% of the forested acres. The general distribution of old growth is displayed on the following map where 30 meter pixels are highlighted in red where old growth currently exists.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1
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During the past three years, the Chewaucan Biophysical Monitoring Team has collected data and analyzed old-growth conditions on 21 forest sites within the Upper Chewaucan watershed. According to the Monitoring Team's analysis, the population of ponderosa pine within old-growth sites seems to be declining overall. Much of the ponderosa pine old growth is in very late seral condition and will need thinning from below in order to maintain a strong presence of old ponderosa pine trees and restore appropriate site capacity. There are a few sites with heavy ponderosa pine reproduction, but these sites too will need management to maintain the health of the old ponderosa pine.

The lodgepole pine in the old-growth ponderosa pine sites is almost entirely in mid to late seral condition, with one site showing only recent appearance of lodgepole. The lodgepole pine is reproducing very heavily where present and will surpass, and perhaps replace, ponderosa pine if left alone.

The white fir is very similar to the lodgepole pine, showing signs of recent entry in places and mid to late seral condition for most of the old growth. However, on some sites white fir is in very late condition. Like the lodgepole pine, the white fir is reproducing very well where present and could come to dominate or co-dominate the watershed.

Forest Service watershed analyses report similar findings. They indicate that overstocked understories in many stands are causing overstory mortality of large trees and an unraveling of late/old seral forest characteristics. (Upper Chewaucan, p. CC-20; Deep Creek, p. CC-37 and Lower Chewaucan, p. CC-37).

Current Management Direction

Current Forest Service management direction for old growth is based on the "Eastside Screens," which were adopted in 1994 and amended in 1995. Timber sale harvest activities are not allowed in late and old structural stage forests that are below historical range of variability, except where it will enhance the LOS character. All remnant late and old seral and/or structural live trees greater than 21 inches in diameter must be maintained. In stands that are not in late and old structural condition, treatments must move stands toward appropriate late and old structural conditions to meet historical range of variability. Open, park-like stand conditions must be maintained where this condition occurred historically. Treatments must encourage the development and maintenance of large diameter, open canopy structure. (ICBEMP Eastside Draft EIS, p. 3-71)

Fire and Salvage Impacts

In recent years, wildfires have caused significant losses of mature and old-growth forests. In 2002, the Winter Fire burned 34,000 acres, killing 50-80% of the trees across 70% of the burn area. The Grizzly Fire burned 3,760 acres of national forest land and 2,065 acres of adjacent private land. The Eastside Screens require salvage sales to provide 100% of potential population levels of woodpeckers and other primary cavity excavators. The Fremont forest plan standard calls for leaving a minimum of three snags per acre greater than 15 inches in diameter, plus one 10-inch snag. However, in portions of the Cub salvage sale the Fremont Sawmill agreed to retain all ponderosa pine trees larger than 28 inches in diameter as large tree snag habitat, and in the Winter Salvage Sale the Forest Service left additional snags in wildlife patches. The Klamath Tribes' forest management plan and Johnson and Franklin (2009) support leaving large dead trees following burns.

Recent surveys by the Chewaucan Biophysical Monitoring Team raise concerns about natural recruitment of trees in severely burned areas, some of which have virtually no trees growing on hundreds of contiguous acres. More than 50 percent of the areas surveyed 4 to 7 years after catastrophic wildfire had fewere than 25 trees per acre replacing mature trees that were destroyed. The tool used to fund tree regeneration may need revision allowing for planting in non-harvested areas. These areas of no regeneration would make excellent candidates for planting trees as part of a carbon sequestration project that might pay some or all of the planting costs. However, as Johnson and Franklin (2009) point out, it will be desirable to avoid overly dense, uniform stands that would result from applying conventional standards of "full stocking."

Old-Growth Guidelines:

- Retain all large (>21"), old (presettlement, > 120 years) trees and large snags, and provide for their replacement over time. In the long run, as more trees grow and age to old-growth condition, proportional removal of those trees may be appropriate.
- Propose adjustments to Eastside Screens to allow cutting of large (>21", but less than 120 years old) white fir in stands currently or historically dominated by ponderosa pine (like Klamath Tribe plan)
- Identify old-growth stands that should be high priority for restoration treatment.
- Propose guidelines for salvage logging to retain large dead trees (like Klamath Tribe plan, but bias retention of >21" snags toward largest available).

3. Invasive Species and Noxious Weeds

Objective: Eliminate and control spread of noxious weeds.

Habitat for noxious weeds is prevalent throughout much of the LFSU due to past management activities, overgrazing, and road construction. Weeds seem to be expanding each year. (Upper Chewaucan WA, p. CC-10; Deep Creek WA, p. CC-21).

The spread of non-native cheatgrass (*Bromus tectorum*, not formally designated as a noxious weed) is an especially serious problem in much of the Unit. Cheatgrass crowds out the native vegetations, hoards critical resources like water and potassium, and destroys the forage and habitat for wildlife. Also, when cheatgrass takes hold, it can change the site's fire regime, increasing fire frequency and intensity.

Another non-native grass, Medusahead (Taeniatherum caput-madusa) may also be making its way into the Unit. It is very competitive against native grasses, helps introduce fire into non-fire prone areas, and may combine with cheatgrass to cause havoc. A few species of Thistle (Musk, Scotch, Bull) also are increasing on disturbed, bare soils throughout the Unit, primarily on landings and along roadways. Knapweeds are being effectively controlled.

Noxious grasses are a telltale sign that the Unit is being degraded. Much of the area is not carpeted by an effective ground cover, creating openings for the invasive grasses and weeds. Sub-soiling has contributed to this condition at all elevations, according to recent monitoring. The non-native grasses pull vital and limited elements and minerals such as potassium out of circulation, which harms the conifers.

One problem with efforts to restore native grasses has been the absence of adequate seed and nursery stock. One possible solution is to use another non-native grass like crested wheatgrass as a way to prevent the spread of cheatgrass and as a transition to native grasses.

The Forest Service has accomplished noxious weed treatments on an average of 653 acres in the past seven years, of which 35 percent have been treated manually and 65 percent have been sprayed with herbicides.

NOXIOUS WEED TREATMENTS IN THE LAKEVIEW FEDERAL STEWARDSHIP UNIT, 2003-2009

	2003	2004	2005	2006	2007	2008	2009
Manual	182.9	130.3	214	363.3	293.1	173.8	231.8
Herbicide	277.5	601.6	359.1	623.6	566.7	300.7	254.8
Total	**460.4**	**731.9**	**573.1**	**986.9**	**859.8**	**474.5**	**486.6**

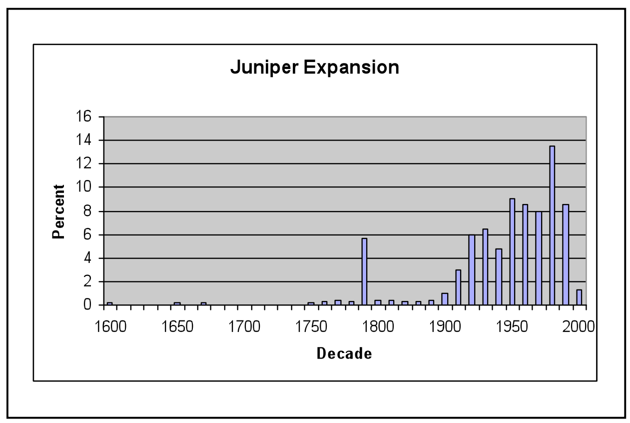
Invasive Species and Noxious Weeds Guidelines:

- Take precautions to ensure that weeds do not spread into areas where they do not currently exist – e.g. by avoiding sub-soiling and maintaining effective ground cover.
- Increase weed monitoring and eradication efforts, especially in juniper treatment areas. Secure access to a soil lab to analyze monitoring samples on a regular basis.

4. Juniper Encroachment

Objective: Restore forest conditions that approximate historical species composition and stand ages.

Prior to Euro-American settlement, many dry areas supported native bunchgrasses and sagebrush-steppe. Juniper was confined to rocky hillsides, ridges, and outcrops. Fire exclusion and overgrazing have allowed juniper to expand into communities historically dominated by sagebrush. (Lower Chewaucan WA, p. RC-8). With fire suppression, livestock grazing and, possibly, climate variation and change, juniper has come to dominate many areas. The juniper pockets have expanded and become more densely stocked, encroaching in aspen stands, riparian areas, and meadows.



The spread of juniper woodlands into rangelands poses a serious threat to watershed and ecosystem health on many sites. (Deep Creek WA, p. S&I-10). Juniper expansion has increased the amount of overland flow and erosion. Twelve years of studies done by the Eastern Oregon Agricultural Research Center has shown both erosion and runoff increase dramatically in a juniper woodland landscape versus area returned to a more natural open condition. With treatment the area goes from a little over 2 plants per square yard when dominated by juniper to 11-12 plants per square yard, increasing water absorption and reducing erosion. If these juniper areas and further encroachment are not managed, juniper will eventually dominate a much larger portion of the Unit. The expected result will be increased watershed degradation affecting site productivity, water quality and quantity, with ecological consequences. (Lower Chewaucan WA, p. S&I-1). Juniper expansion results in the displacement of some wildlife species, as trees dominate areas that previously provided habitat for ground and shrub nesters.

The Forest Service and BLM have undertaken juniper removal within the lower Chewaucan Watershed since 2002. This work is continued with the Jakabe Juniper/Aspen/Meadow Recovery Projects which are designed to restore historical conditions through removal of junipers followed by prescribed fire. No old-growth juniper will be cut. Research studies are showing differences in impacts from spring and fall burns of juniper. Data collected in the juniper treated areas along the Chewaucan River indicate that fall burning exposes and destroys soil structure so that for the next 3 or more years invasive pioneering plants alternately dominate the site along with cheatgrass. Juniper burned on snow has a much lower impact on soil structure and follows a succession similar to the juniper that is left unburned. Plant communities under the juniper are slowly being succeeded by plant associations common to the surrounding area. The process is very slow and may take longer than the 12 years suggested.

Initial monitoring of the juniper removal program has raised concerns about accelerating the spread of cheatgrass through soil disturbance and prescribed fire. A review of the studies done by Eastern Oregon Argricultural Reseach Center shows that while cheatgrass enters following disturbance, within twelve years native vegetation out-competes the cheatgrass and only small amounts remain. In one area with 7 sites, we have seen cheatgrass being replaced by Japanese brome. Cheatgrass trends need to be monitored, as twelve years is a very short time in ecosystem terms, and the sites in the study are different from those in the Unit.

<u>Juniper Guidelines:</u>

- Use prescribed fire and control grazing to avoid spread of juniper.
- Take an adaptive management approach toward juniper removal, including careful monitoring of impacts on effective ground cover, cheatgrass spread and burning times. Assess and attempt to improve vigor of existing herbaceous vegetation before removing juniper.

B. Soils and Water

Goal: Sustain and restore the land's capacity to absorb, store, and distribute quality water.
Objectives:

- *Manage upland vegetation to maintain and restore water and moisture absorption, retention, and release capacity over time.*
- *Maintain and improve aquatic and riparian habitat for native species.*
- *Lower stream temperature and sediment loads.*
- *Improve biophysical structure of soils.*
- *Restore forest health through treatments without undue disturbance.*

Soil and water are two interdependent critical resources at the landscape level. Water and soil quality are intimately linked to nature's activity at the topsoil and subsurface levels. Soil quality is intimately linked to the infiltrating moisture to dissolve minerals and move nutrients within the root zone where plants can access them.

Soil Functions and Repair

Topsoil is an atmospheric sink that collects solar inputs, gases, fuels, particulate matter, nutrients, litter and precipitation. It has to both utilize and buffer these inputs. Forest topsoil is created and supported by a specific architecture and mix of bacterial, fungal and soil animal populations to process not only what lands on top but what is underneath. The architecture or aggregate has to support the passage of air and water and feeder roots or the life above it is compromised. Compaction, displacement, erosion, and desiccation are the chief modifiers and destroyers of this habitat, its inhabitants and its functioning. Unacceptable levels of soil compaction and displacement have been observed across many areas of the Unit. (Lower Chewaucan WA, p. S&I-7).

During the last 3 years the Chewaucan Biophysical Monitoring Team has studied the impact of ground-based logging following revised Forest Service protocols on 56 sites. Sites show less compaction on cutting lanes, higher recruitment of down woody debris throughout the projects, and wide swaths of untouched soils in the corridors between the cutting lanes. Future studies will analyze vegetation recovery and compaction trends. Sites harvested over snow show little to no compaction or soil displacement. Plant responses following harvest over snow are immediate and demonstrate a wider range of species diversity. Soils conservation must remain a priority. A forest lives or dies from the ground up.

Soil development is a top-down process that takes millennia to create an adequate and functional topsoil. The Chewaucan monitoring team has found that the average organic soil layer is 2.2 inches thick, the product of 6,900 years of formation. Much of it lies on top of the soft unconsolidated ash and pumice from the eruption of Mt. Mazama. In the Upper Chewaucan Mazama ash soils tend to lie on top of older, thicker Western Cascade soils. Though it may have experienced many cycles of vegetative life, it is still young and developing in most areas throughout the watershed. Some exposed areas may never have been able to build an organic layer, while others have become exposed and contain remnant organics.

An effective ground cover is critical in order to establish and maintain soil repair. There are three general classes of effective ground cover:

- cryptobiotic crusts of mosses and lichen (rare within the Chewaucan);
- grasses and forbs (quite common, yet in various levels of health); and
- thatched duff (primarily found in the mixed coniferous stands and old growth).

Exposed organic and bare mineral soils are subject to frost heaving and accelerated erosion from heavy seasonal rains. The exposed remnant organic soils can be protected from further erosion through planting of native grasses and forbs. We need to identify ways to restore the nutrient base without further disturbing the effective ground cover. The effectiveness of sub-soiling continues to be monitored. Surveys of subsoiled areas have shown that the sub-soiled areas, while initially releasing the compaction, ultimately become more compacted than their immediate surroundings. The furls formed by the rippers become beds for invasive plants. Loss of effective ground cover is also dramatic in comparison to the immediate surroundings (*Assessing The Use of Sub-Soiling Within the Upper Chewaucan Watershed.* Report of June 4, 2004).

Surveys of landings and decommissioned roads using vegetative recovery as an indicator of soil recovery indicate that lightly scarified areas (4 – 6 inches) recover 1.8 times faster than blocked areas which recover 4 - 8 times faster than subsoiled areas. Many subsoiled areas are still predominately bare after 30 to 40 years. (www.lcri.org/monitoring/reports/road decommissioning (2 reports)).

The Chewaucan Biophysical Monitoring Crew began analyzing soils in all sites using a LaMotte Smart 2 Soil Colorimeter in 2006. This spectrophotometer is highly reliable, giving repeatable results in concentrations of parts per hundred million (mg/100L). This tool is revealing soil nutrient levels following wildfire, prescribed fire, juniper treatment, harvest, and wood decomposition. Trend studies using this tool will be invaluable in determining soil health. Current data and discussions can be accessed at www.lcri.org/monitoring/reports/soil chemistry.

Ecosystem Changes

The Chewaucan Biophysical Monitoring program is addressing system mosaics along the sub-watershed gradients to provide insight into compositional changes and potential gains or losses of biodiversity and ecological complexity within the Unit. The changes coming into view are synergistic, as plant assemblages seem to be simplifying due to climate change and invasive species incursions. Predictable plant associations are less dominant, giving way to varying plant assemblages on similar sites. Stand types have become compromised because of species incursions due to fire suppression. Site capacities have been exceeded because of large populations of trees and prolonged drought. Appropriate thinning in critical areas will give needed relief in many stands as well as reduce their fuel and fire hazards.

One of the consequences of past logging has been an interruption of the natural process of dead wood formation by altering the rates of formation and the number, size, and species of woody substrates. These alterations have affected natural reproduction, the mix of vascular and non-vascular plants, and fungi populations. Past logging has also modified the rates and amounts of nutrient cycling, carbon sequestration and soil development, primarily through compaction and displacement. Whole tree harvesting has the potential to increase nutrient removal because of the concentrations of nutrients in branches and needles, which are higher than in the stems.

Stream Functioning

The stream system that has been monitored shows an average of high water clarity, high macroinvertebrate diversity, fair to good channel stability and warm to very warm water. Increased width to depth ratios in stream channels and reduced shading from loss of riparian vegetation are the primary causes of elevated temperatures. (Deep Creek WA, p. C-6). Stream degradation in the Unit and elsewhere in the Interior West has been caused by the cumulative effects of overgrazing, road development, logging, water diversion and impoundment, and other human activities.

Fish, especially redband trout, seem to have acclimated to the temperature, but fish passage is still an issue that is being addressed. Between 2002 and 2007, culvert replacements have opened up many miles of streams to redband trout. The Chewaucan Biophysical Monitoring Team has been monitoring many of these culverts and streams for upstream fish use. A notable success has been Puppydog Creek, where the crew observed successful fish migration for more than two miles upstream, using freshwater mussels as an indicator of fish migration. The glochidia (mussel larva) attach to redband trout gills to move upstream. Redband trout have been observed in many of the streams above replaced culverts.

Peak flows appear to be higher currently than in historic times. The Chewaucan River experienced peak flows exceeding the 100-year event during extreme rain-on-snow events in 1964 and 1997. Peak flows have the potential to be higher with increased drainage efficiency from roads. Current drainage efficiency increases have been calculated in the range of 35% to 170%. Also, high levels of compacted soils are contributing to higher peak flows. (Upper Chewaucan WA, p. C-3)

Riparian Areas

Present riparian vegetation generally occurs in narrow bands along the streams, springs, seeps, and lake shores due to lowered water table caused by stream incision or reduced contributions from upland sources, sometimes resulting from increased density of conifer cover. Generally, willows and other deciduous species such as black cottonwood are lower in extent, density and cover than in historic times. Stream downcutting resulting from overgrazing and, to a lesser extent, recreational pressure, is very evident in some areas. (Upper Chewaucan WA, p. CC-10). Areas that have been resurveyed show a marked improvement in vegetative stabilization and bank healing as grazing practices change or are enforced.

<u>Soil and Water Guidelines:</u>

- Initiate Unit-specific research to determine the distribution of nutrients in different parts (needles, branches, boles) in trees of various sizes so that nutrient removals from logging can be determined and reflected in the biomass harvest plans. Answers are needed for the following: What would be the magnitude of loss of nutrients, snag and down wood habitat under the proposed biomass utilization within the Unit? How sustainable are these losses of nutrients and large down wood? Will natural weathering rates and other inputs compensate for nutrient removal in the harvested logs within the Unit? Baseline surveys by the Chewaucan Biophysical Monitoring Team show a slight decrease in soil nutrient levels. Will soil nutrient levels increase to pre-harvest levels over the next few years? If not, the decrease becomes significant. Over the next few years as soil nutrients cycle, a clear picture of nutrient cycling will begin to emerge to answer these questions. Baseline data can be accessed at www.lcri.org/monitoring/reports/soil chemistry.
- Timber sale planning needs to address both the spatial distribution and intensity of disturbance to the soils and their vegetative cover. Baseline data in the Bull Stewardship and Jakabe Project areas (46 sites) have been analyzed for soil and vegetation changes. They have also been modeled in Landscape Management Systems (LMS). The preliminary data can be viewed at www.lcri.org/monitoring/ queries and www.lcri.org/monitoring/reports/LMS.
- Restore and enhance the Unit's effective ground cover. A disproportionate amount of bare mineral soil within the Unit has been subject to wind and water erosion.
- Utilize old skid trails to the extent necessary, limiting new permanent logging skid trails to approximately 7% of the total area. Survey and choose those skid trails where the soils are shallow, rocky, and/or on previously disturbed ridge areas. The sales administrator or contract field officer needs to convey to the logging boss and crew the necessity to stay on flagged roads and away from recovering soils, with the exception of well developed grass areas. Monitoring by the Chewaucan Biophysical Monitoring Team indicate that these practices **are** being implemented and **are** responsible for monitoring data showing less damage to soils than older timber sale the team has monitored.
- Accurately map and record the areas that are or will be occupied by a permanent road system and retain this information in the monitoring records.
- Sub-soiling needs to be monitored and analyzed before more area is treated to determine the effectiveness of the treatment. Present monitoring data show that many disturbed areas that haven't been sub-soiled are repairing themselves and are showing similar conifer growth as the treated areas. Sample monitoring of treated areas should continue.
- Continue to improve fish passage and habitat. Aquatic macroinvertebrate sampling shows healthy diversity and populations in all sub-sheds within the Upper Chewaucan. Sampling needs to extend to the rest of the Unit.
- Map and protect from grazing and OHV use those riparian and stream channel areas that are vulnerable to adverse effects or are not recovering at optimal rates.

C. Fish and Wildlife

Objectives:

- *Reduce road density and improve remaining roads to minimize impacts on water quality and flow.*
- *Maintain and improve aquatic and riparian habitat for native species.*
- *Lower stream temperature and sediment loads.*
- *Improve opportunities for people to fish, hunt, and view nature.*
- *Maintain and restore habitat for focal species.*

The Lakeview Stewardship Unit is the home of many mammals, birds, fish, and other species that are typically found in the relatively dry, high elevation forests, rangelands, streams, and lakes of south-central Oregon, as well as some species that are unique to the area. Threatened and endangered species within the Unit are the northern bald eagle and Warner sucker; American peregrine falcon was de-listed in 2000. Species that have administrative status are the redband trout (USFS Region 6 sensitive, ODFW sensitive), Goose Lake sucker (USFS Region 6 sensitive, ODFW sensitive), Goose Lake lamprey (USFS Region 6 sensitive, ODFW sensitive), and pit roach (USFS Region 6 sensitive-proposed, ODFW sensitive). Indicator species associated with old growth forests include the pileated woodpecker, goshawk, American marten, three-toed woodpecker and black-backed woodpecker. White-headed woodpeckers, while not currently abundant in the area, should benefit from protection and restoration of old-growth ponderosa pine. The Red-naped Sapsucker is an indicator species for aspen groves. Other important species in the Unit include elk, deer, California bighorn sheep, and beaver.

The Forest Service Regional Office is currently leading an effort to identify focal (or surrogate) species to be used in the process of revising forest plans. Information from that effort may be incorporated into future versions of this long-range strategy.

Terrestrial Species and Habitats

Big Game: Elk started reestablishing themselves in the 1960s, and their population for a long time seemed to be on the increase. Those increases have leveled off due in part to a disease known as red water. The deer populations seem to have stabilized from the lows of the 1960s. Reducing forest stocking levels and reintroducing fire should provide habitat favorable to both these species. Variable-density thinning and road closures will help provide hiding cover and security.

Northern Bald Eagle, Pileated Woodpecker, Goshawk, American Marten, Three-toed Woodpecker and Black-backed Woodpecker: These species have been affected by timber harvest, plant succession, fire suppression and road density. Managing according to the Unit objectives and goals will improve habitat availability for these species by variously favoring the retention and development of large trees and snags and the development of complex forest landscapes. Snags are an essential habitat component, both as nesting and foraging sites for woodpeckers and for a variety of birds and mammals that secondarily make use of woodpecker nesting and roosting cavities. Snag-retention guidelines for both green and post-fire stands need to be updated to reflect current understanding of the needs of species associated with this habitat component. Encouraging firewood cutting in lodgepole pine versus taking large ponderosa pine snags will also help.

Red-naped Sapsucker: Aspen is gradually being replaced by conifers over time as a result of plant succession and fire suppression. Livestock and big game grazing on aspen is setting back regeneration. Reintroduction of fire and conifer management is needed to restore stands to later structural stages. Some stands will need temporary or full livestock exclusion in order to reach the desired future condition.

White-headed woodpecker: Like other woodpeckers, this species nests in snags but generally forages for insects on the bark rather than drilling into trees for beetle larvae. It is unique among woodpeckers in using the seeds of ponderosa pine as a winter food source. Larger, older ponderosa pine are particularly important because they produce more cones and seeds. Populations of this species are depressed throughout eastern Oregon. Unit objectives of retaining large, old ponderosa pine, improving their vigor, and growing more large pine should benefit this species over time.

Aquatic/Riparian Species and Habitats

Forest Vegetation Conditions: Over 50% of the forested community is outside recommended canopy ranges and are functioning inappropriately. Conifers have expanded into nearly every meadow and most riparian areas throughout the Unit, promoting competition with riparian vegetation (willows, aspen, cottonwood, alder) necessary to maintain proper stream types and bank stability. The woodlands are replacing numerous vegetative types, leaving soils prone to erosion and reducing late summer stream flows. The increased conifer densities are likely contributing to lower base flows, but the extent is unknown.

The Unit goals of restoring natural stand structures and fire regimes will improve these conditions. Conifers that have encroached into riparian areas should be thinned and fire reintroduced.

Road Density, Location and Drainage: Road density and location are for the most part causing streams to be in a “functioning appropriately but-at-risk” condition. Goals for the Unit should be a maximum road density of 1.7 mi/mi^2 and a priority placed on removing or fixing roads within 300’ of streams. The remaining roads should be properly drained to reduce hydrological connection to stream channels, resulting in less water and sediment flowing down roads and their ditches. This will also improve spawning gravel fines in most streams.

Riparian Vegetation and Associated Bank Stability: Within the Unit the majority of type B and E streams are functioning appropriately and characterized as having an abundance of late seral vegetation and high bank stability. The Upper Chewaucan Watershed Assessment reports that Type C streams that are predominately associated with large meadows are not functioning appropriately because of low bank stability and lack of sedge, rush and willow. Because gravel point bars are common in C stream types, greater densities of willow are expected relative to other stream types. Grazing standards need to promote willows and late-seral plant conditions to solve this problem on type C streams.

There is evidence that some of the large meadows with type C streams may never have had an abundance of willows. Several long-term livestock exclosures in these large meadows have not resulted in willow re-establishment. On numerous sites as these large meadows narrow into smaller draws, we find an abundance of willows with the same level of livestock grazing occurring. It appears that the soils combined with higher water tables may be the main reason willows never established in these large meadows. In the past, private land meadows were sprayed to control willows. This, along with the lack of beaver activity, may be another reason for low populations of willows in these large meadows under private ownership. Considering these differences, each meadow needs to be evaluated as to whether or not willows ever grew there and can be restored.

Large Woody Debris (LWD): Large wood in streams is important for controlling sediment transport, stabilizing stream banks, creating channel structure, and dissipating energy of water. Almost all streams in the Unit have low LWD numbers. This is probably due to past timber harvest practices and removal of LWD from streams. In the short term LWD needs to be artificially put into streams. In the long term LWD recruitment will be achieved by following Unit goals.

Fish Passage: In the original 2005 Strategy the three irrigation weirs on the Chewaucan River were identified as blockages for redband trout for over 50 years. Since that time the major ranches involved in the project -- the J-Spear, ZX, Murphy and O'Leary ranches -- undertook a major project to remove the Paisley Weir. The Oregon Department of Fish and Wildlife installed fish ladders on the Redhouse and Narrows weirs. The ranches undertook an almost $3 million dollar project to remove the Paisley Weir and install a new diversion that did not block fish passage. In total this project has opened up over 120 miles of stream to Redband Trout. The next immediate blockage is the down cut on Thomas Creek that currently prevents fish migration into the Unit. On other streams in the Unit, culverts are barriers.

Macroinvertebrates: The Chewaucan River has excellent macroinvertebrate populations and diversity, the Thomas Creek watershed has low populations, and we lack information on other streams. Macroinvertebrate diversity is an indicator of water quality. More data are needed to determine what water quality parameters are causing the decline of macroinvertebrates in Thomas Creek.

Beaver: Beavers provide a number of benefits to riparian and aquatic ecosystems. Higher stream levels and water tables due to beaver dams increase and diversify vegetation adjacent to streams. In summer, the increased woody vegetation shades and cools the water, improving fish habitat. Pools behind beaver dams provide more living space for trout, while improving water quality in the stream. Water is re-oxygenated as it falls over beaver dams. By backing up and deepening water, beaver dams help keep it from freezing solid in winter and reduce its temperature in summer. They also allow cooler groundwater to enter the stream from adjacent land. It percolates back into the stream during low-flow periods, increasing water in the channel. In addition, beaver dams reduce the stream's energy by slowing its velocity. Spring runoff is retarded, and its scouring effect reduced. Instead of causing streambank erosion, sediment is deposited. Responding to new water elevations, channels are constantly forming and old ones are filling in.

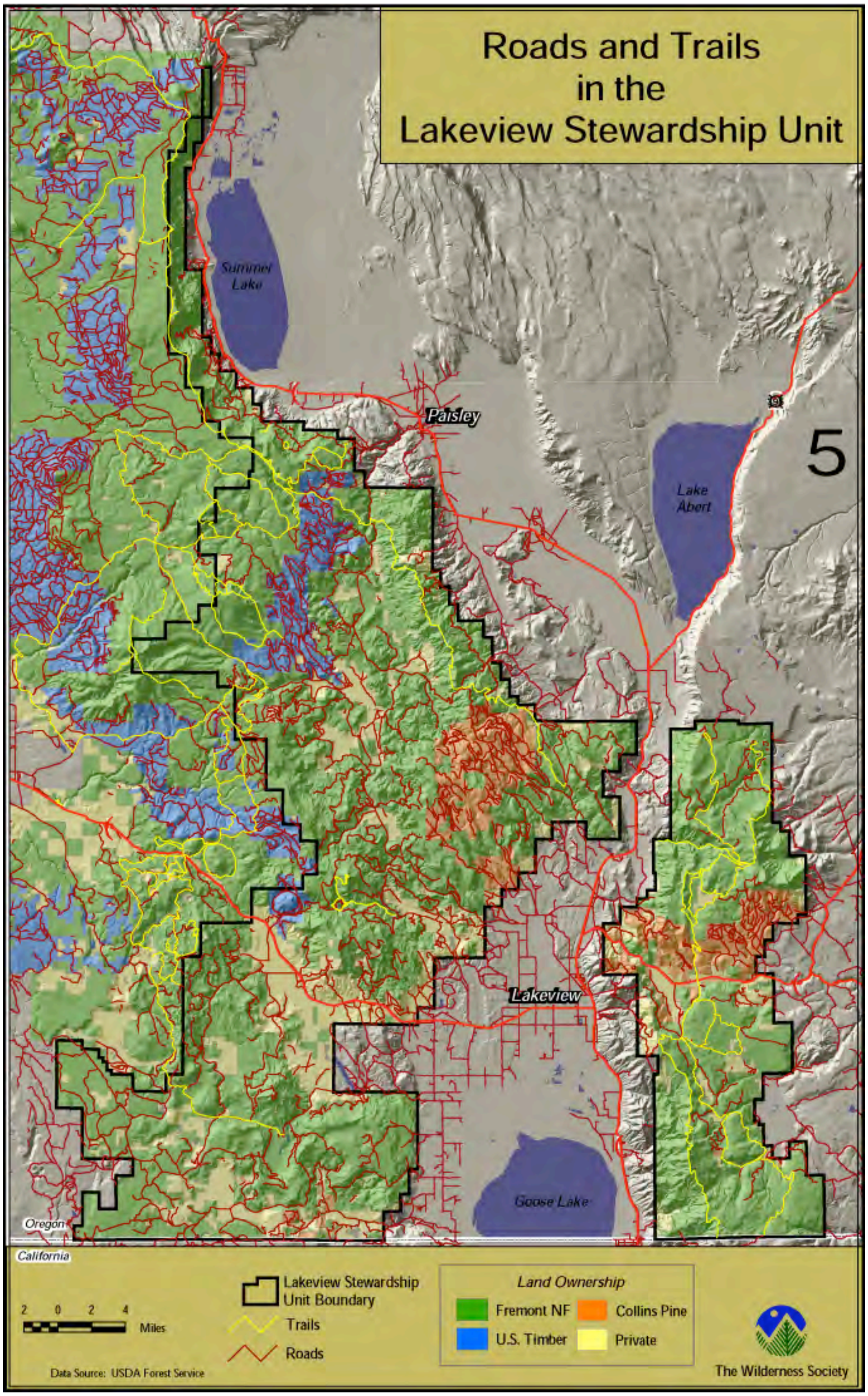
Beginning in the 1800s, beaver populations were systematically decimated by trapping and their habitats were degraded by overgrazing. Populations and habitats have been slowly improving for several decades, but some currently suitable habitat remains unoccupied and more habitat can be restored.

<u>Fish and Wildlife Guidelines:</u>

- Implement recommendations for big game and old-growth associated species contained in the Forest Service watershed analyses.
- Restore native riparian vegetation (willows, aspen, shrubs) and improve water quality through appropriate grazing standards, careful thinning and burning of encroaching conifers, and reintroduction of beaver.
- Reduce road densities and improve road drainage, particularly near streams.
- Complete fish passage improvements (e.g. replacing road culverts) to restore fish populations in the Unit.

D. Roads

Objective: Reduce road density and improve remaining roads to minimize impacts on water quality and flow.



High density of open roads is a critical issue for the area. (Deep Creek WA, p. SI-2).
Roads are producing the highest rates of soil loss on a per acre basis and are partially responsible for decreased base flow in perennial streams. (Upper Chewaucan, p. SI-1, SI-7).

Data contained in Forest Service watershed analyses indicate that high road densities are prevalent in much of the LFSU. In the Upper Chewaucan watershed the average road density is 2.9 miles per square mile. In the Lower Chewaucan, average road density is 2.8 miles per square mile. In Deep Creek, average road density is 2.4 miles per square mile. The Forest Service watershed analyses recommend reducing road densities to 1-2 miles per square mile. (Upper Chewaucan WA, p. R-2; Lower Chewaucan WA, p. R-1).

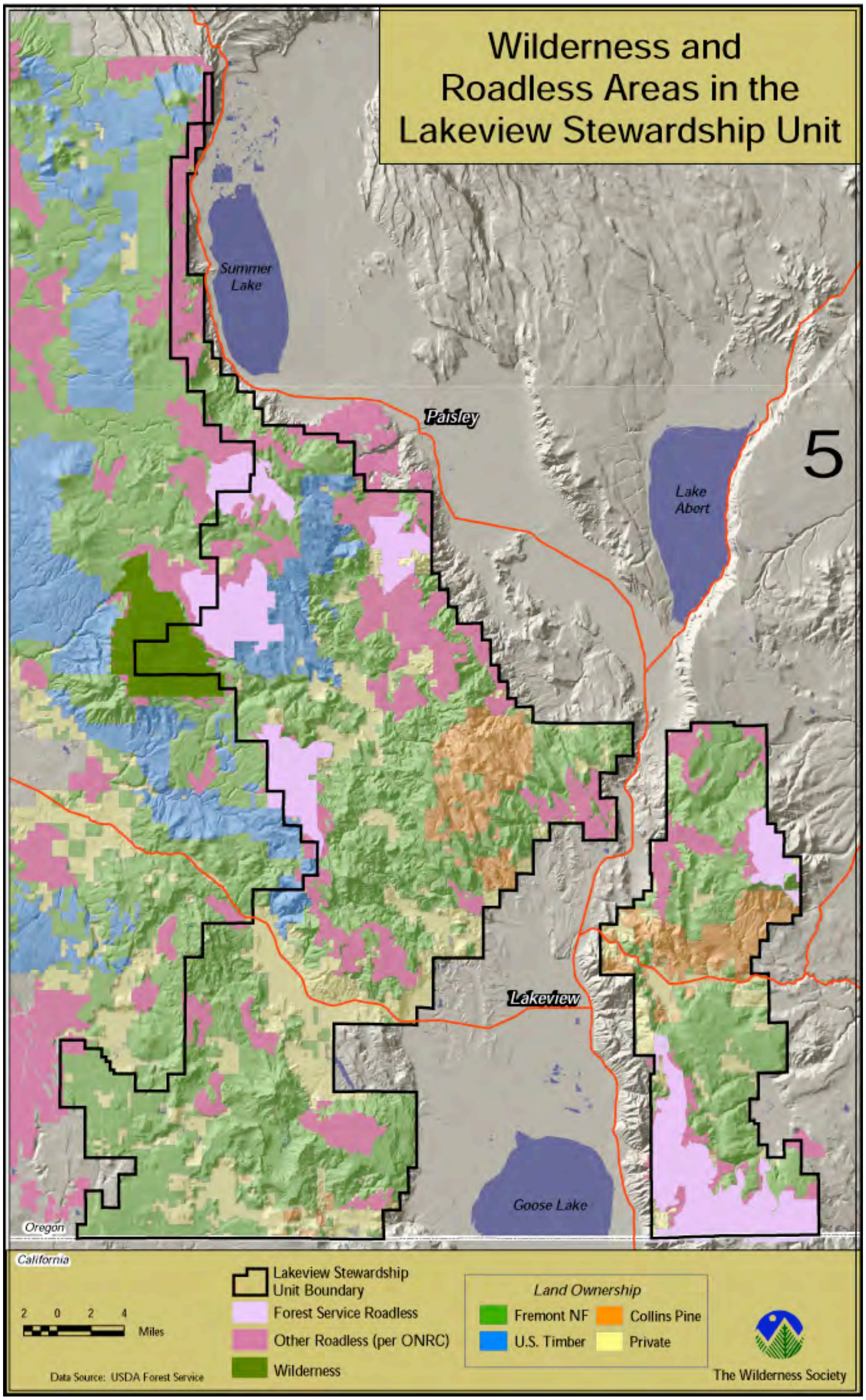
The existing road system was designed and constructed primarily to accommodate logging systems that required a significantly denser road network than is required by the systems commonly used today. Furthermore, funding for road maintenance is insufficient to sustain the existing road network. Consequently, the Forest Service rarely builds new roads and instead has begun to close and decommission many roads in order to restore hydrological function and reduce maintenance costs.

During the late 1990s, the Lakeview Ranger District completed transportation plans for the North and South Warner Mountains and Thomas Creek Watershed. The plans identified numerous roads that were no longer needed for the forest transportation system. The Forest Service subsequently decommissioned 100 miles of old roads in 2001 and another 20 miles in 2002. (LFSU 2001-2002 Annual Report). Additional road decommissioning has been planned, approved, and partly implemented in subsequent restoration projects such as West Drews where 90 miles of roads have been identified for decommissioning or closure.

<u>Road Guidelines:</u>

- Identify road access needs for restoration work, fire control, private land management, recreation, and other uses.
- Identify priorities for road closures and improvements, including relocation of roads away from streams. Consider opportunities for road closures to improve habitat connectivity and enlarge roadless areas. Wherever possible, replace problem culverts with broad-based dips.
- Design restoration treatments to avoid any permanent road construction. Avoid temporary road construction to the extent feasible.
- Provide adequate funding or contract stipulations to ensure that temporary access roads are promptly decommissioned as part of the project.
- Reduce overall road density initially to less than 2 miles per square mile, with a long-term goal of reducing roads to the minimum necessary to achieve Unit goals and objectives.

E. Wilderness and Roadless Areas



Wilderness

The Fremont National Forest has one designated wilderness area, Gearhart Mountain Wilderness (22,809 acres), of which about 30 percent (6,832 acres) is located within the LFSU. Gearhart Mountain Wilderness was originally designated in the Wilderness Act of 1964, and the Oregon Wilderness Act of 1984 added 4,114 acres.

In wilderness areas, allowable recreational uses include hunting, fishing, hiking, horse riding, backcountry camping, and cross-country skiing. However, motorized and mechanized recreation vehicles, including ATVs, snowmobiles, and mountain bikes are not allowed. Livestock grazing is permitted in wilderness areas, but not logging or mining.

According to the 1989 Fremont Forest Plan EIS, recreation use in Gearhart Wilderness is concentrated in a few small areas, with Blue Lake receiving 70 percent of use, mostly fishing. The EIS estimated 3,100 RVDs of wilderness use in 1981 and predicted that recreation demand would exceed carrying capacity by year 2000.

The Forest Service will consider recommending additional wilderness areas for the Fremont National Forest when it revises the Fremont-Winema National Forests plan in the coming years. The review of potential wilderness areas is required by the Oregon Wilderness Act.

Roadless Areas

The 1989 Fremont National Forest Plan EIS evaluated 10 inventoried roadless areas, totaling 83,360 acres. Of these, all or parts of 7 are within the LFSU, for a total of 64,259 acres. Three are located in the Warner Mountains east of Lakeview: Crane Mountain (23,261 acres), Mount Bidwell (4,679 acres adjacent to Crane Mountain), and Drake-McDowell (5,768 acres). Four are located west of Lakeview and Paisley: Deadhorse Rim (12,420 acres), Coleman Rim (8,393 acres), Hanan Trail (9,039 acres), and Brattain Butte (5,880 acres).

The 1989 Fremont National Forest Plan allocated the roadless areas to a variety of management areas, such as semi-primitive motorized recreation, semi-primitive non-motorized recreation, timber/forage production, etc. The 2001 Roadless Area Conservation Rule generally prohibited road building and commercial logging within inventoried roadless areas, with various exceptions such as logging to reduce fire risk. In May 2005, the Roadless Rule was replaced with a state petition process that allows governors for 18 months to request roadless area protection or management changes within their respective states. If no petition is filed, roadless area management direction reverts to the local forest plan.

Additional areas larger than 1,000 acres have been identified by Oregon Natural Resources Council. These unroaded areas are shown on the Wilderness and Roadless Areas map along with the Forest Service inventoried roadless areas.

Within the Upper Chewaucan watersheds are two inventoried roadless areas, Deadhorse and Coleman, and a portion of the Gearhart Mountain Wilderness. These vast primitive and semi-primitive areas provide a unique recreation experience for the forest user and offer an undisturbed habitat for the growing deer and elk herds. (Upper Chewaucan WA, p. C-12-13)

Of the 64,219 acres of inventoried roadless areas, 4,294 acres (7%) are low-elevation ponderosa pine stands, while another 5,984 acres (9%) are high-elevation ponderosa pine on southwest-facing slopes. Most of the low-elevation pine is located in portions of the Coleman and Brattain Butte inventoried roadless areas. As discussed in the Fuels and Fire section, 25% of the total Unit is low-elevation ponderosa pine and another 10% is high-elevation ponderosa pine on southwest-facing slopes. Thus, a relatively small amount of the inventoried roadless areas appears to be in priority areas for treatment to reduce fuels and fire risk. Of course, what types of treatment, if any, are needed and appropriate will depend on site-specific inspection and analysis of actual stand conditions and other factors.

Organizational Views of LSG Members

In seeking to find common ground on the often-contentious wilderness and roadless area issues, it is important to understand the positions that organizations represented in the Lakeview Stewardship Group have taken in the past.

For example, The Collins Companies' Position Statement on Federal Land Management (January 2001) includes the following statement – "We believe that the U.S. National Forests should be looked upon as providing both wilderness preserves and sustainable resources for the benefit of all. To this extent, we offer the following recommendations: 1. Maintain as wilderness areas, those areas that have been so designated through 1996. 2. Maintain as roadless areas, those areas of at least 5,000 acres that were roadless in 1996." The full Collins position statement on federal land management is at
http://www.collinswood.com/M4_MediaEvents/Resources/PositionStatement.htm

On the other hand, The Wilderness Society's National Forest Vision Statement (February 1999) contains the following recommendations –

- "Designate substantial additional wilderness to conserve biological diversity, ensure representation of all ecosystem types, meet recreation needs, and protect other wildland values."
- "Identify and protect from disruption all roadless areas larger than 1000 acres and other landscapes with high ecological integrity."

Wilderness and Roadless Area Guidelines:

- Identify and evaluate potential wilderness areas based on compatibility with existing motorized and non-motorized recreation uses, fuels reduction/fire restoration needs, wildlife habitat values, etc.
- Avoid road construction and commercial logging in roadless areas >5,000 acres. The roadless values and characteristics of areas between 1,000 and 5,000 acres should be evaluated on a case-by-case basis and protected where appropriate.

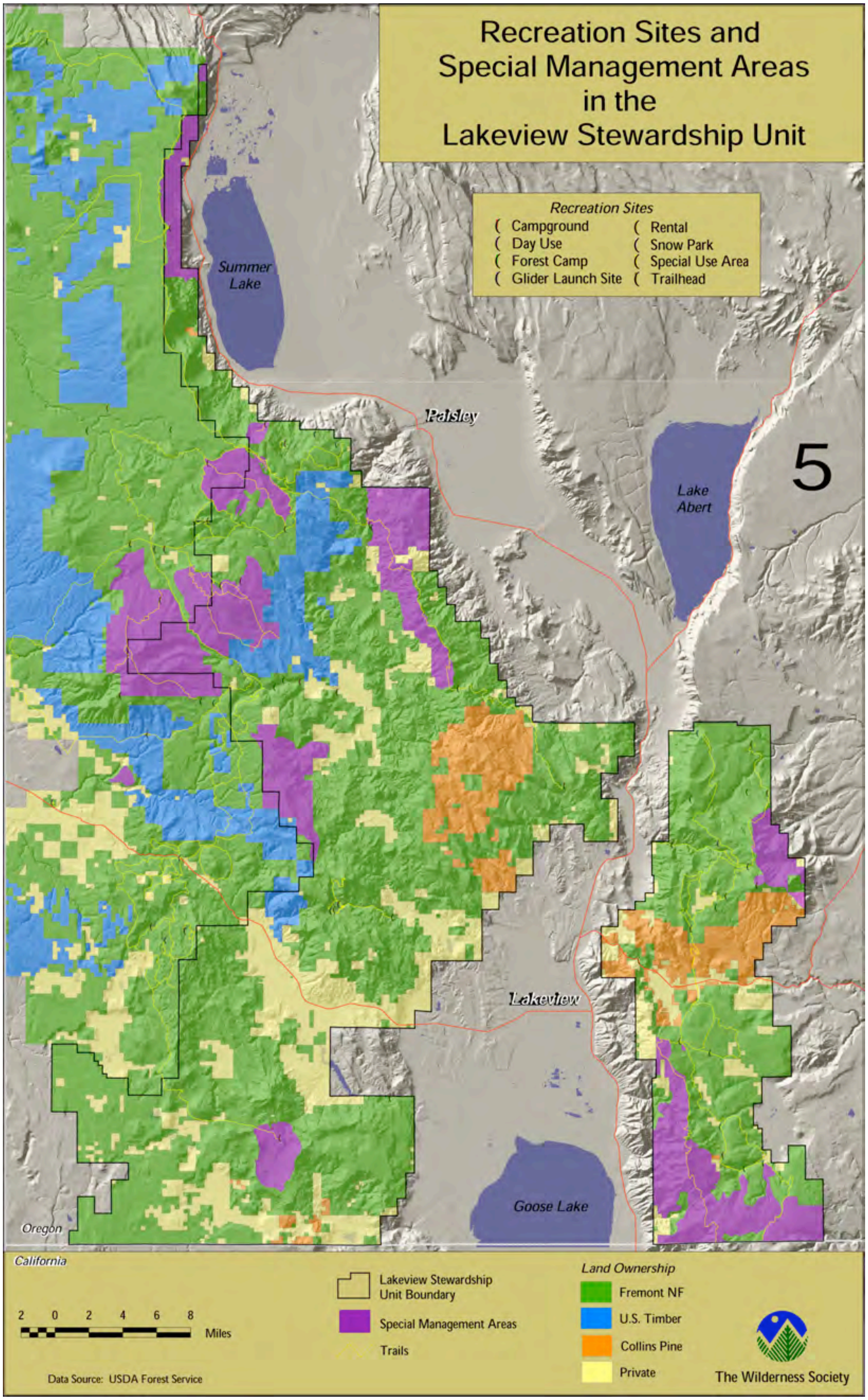
F. Recreation

Goal: Provide opportunities for people to realize their material, spiritual, and recreational values and relationships with the forest.

Objectives:

- *Protect and maintain areas of cultural significance within the forest.*
- *Improve opportunities for people to fish, hunt, and view nature.*
- *Promote environmentally responsible recreation.*

The Lakeview Federal Stewardship Unit has many recreational opportunities and growing numbers of visitors. Outstanding features that attract recreational visitors to the area are the lakes and streams, the roadless semi-primitive areas, the trail systems, and big game hunting opportunities. (Upper Chewaucan WA, p. S&I-38). Recreational activities include hunting, fishing, hiking, horse riding, motorized recreation, backcountry camping, and cross-country skiing. In some areas, use of dispersed and developed recreation sites is increasing at a rate of 10-20% per year, and this trend is expected to continue for the foreseeable future. (Lower Chewaucan WA, p. CC-41).


Recreation Sites and
Special Management Areas
in the
Lakeview Stewardship Unit
Recreation Sites
Campground
Day Use
Forest Camp
Glider Launch Site
Rental
Snow Park
Special Use Area
Trailhead
Summer Lake
Paisley
Lake Abert
5
Lakeview
Goose Lake
Oregon
California
2 0 2 4 6 8
Miles
Lakeview Stewardship Unit Boundary
Special Management Areas
Trails
Land Ownership
Fremont NF
U.S. Timber
Collins Pine
Private
The Wilderness Society
Data Source: USDA Forest Service

Presently, the Unit contains the following recreation sites and facilities:

- 12 trailheads accessing a total of 381 miles of trails (of this total, only 8 miles are motorized trails for ATV use).
- 3 rental cabins.
- 2 hang glider launch areas (Tague's Butte and Hadley Butte).
- Warner Canyon Ski Area (privately-owned)
- Hike-in rustic camping at Slide Lake and the semi-primitive recreational areas in Drake-McDowell Basin and the Crane-Bidwell area.
- 4 day-use/picnicking areas at Clear Springs, Withers Lake, Can Springs and Overton Reservoir.
- 6 forest camps located at Upper Jones, Twin Springs, Mud Creek, Dismal Creek, Deep Creek and Deadhorse Creek with a total of 28 campsites.
- 15 fully developed campgrounds with 105 camp sites along with outhouses, water, picnic areas, fireplaces and fishing at Willow Creek, Marster Springs, Happy Camp, Dog Lake, Drews Creek, Deadhorse Lake, Dairy Point, Cottonwood, Campbell Lake and Chewaucan Crossing.
- 118.5 miles of groomed snowmobile trails, 30 miles of nordic trails and 142.7 miles of summer hiking trails.
- 2 snow parks with toilet facilities, one at Moss Meadow and the other at Camas Prairie.
- A variety of low-impact activities, including bird-watching, wildlife viewing, rock-hounding, archaeological sites, petroglyphs, pictographs and dendroglyphs.

The LFSU has 93,331 acres of Special Management Areas, including the North Brattain, South Brattain, Fort Bidwell, and Crane Mountain Semi-primitive Motorized Recreation Areas; Drake-McDowell Semi-primitive Non-motorized Recreation Area; Dog Lake Special Management Area; Gearhart Mountain Wilderness; and Coleman Rim, Deadhorse Rim, and Hanan Trail Roadless Areas. Covering nearly 20 percent of the Unit, these Special Management Areas contain many of the trails and other recreational attractions.

In 2004, the Forest Service reconstructed and maintained the 24-mile trail system in the Deadhorse Rim Roadless Area, including the Cache Cabin Trail, Dead Horse Rim Trail, Dead Cow Trail, and Lakes Loop Trail. This trail system is an integral part of the highest use recreation area on the Fremont National Forest, providing loop trails between two high elevation lakes and their very popular campgrounds. The trails also provide public access to scenic vistas of the lakes and surrounding country and to some of the largest stands of white-bark pine and old-growth ponderosa pine in Oregon.

Also in 2004, volunteers from several equestrian groups built a horse camp at Moss Meadows near the Fremont Trail. The project was partly funded by a grant from the Oregon State Parks and Recreation Department.

Key Recreation Issues

With recent budget constraints, the LSG is concerned that maintenance of these recreation sites and facilities could be jeopardized. In the past, the Regional Office had given direction to implement a fee demo program, but this has not been accomplished. A fee program could ease the potential impact of possible budget cuts on maintenance of recreation sites.

Current conditions, trends, and development needs should be identified to assist the LSG in making recommendations for the upcoming forest plan revision.

Consideration must be given to the growing use of ORVs and the resulting impact on lands within the Unit. In 2005, the USFS Washington office adopted new policies for ORV use in the national forests. The Fremont-Winema National Forest has traditionally been open to ORV use except in places that are specifically closed to such use, such as the Gearhart Mountain Wilderness. Under the new policies, ORV use may be allowed only on designated routes. Since the Unit currently has just 8 miles of motorized ATV trails, a much more extensive system of designated ATV/ORV trails could be established.

In April 2010, the Fremont-Winema released for public comment an environmental assessment of several alternatives that would prohibit cross-country travel by ORVs and establish a system of designated routes for ORV use. The Forest Service preferred alternative would convert 177 miles of currently closed roads to motorized trails forest-wide, while closing 136 miles of roads that are currently open to motorized use.

<u>Recreation Guidelines:</u>

- Identify funding needs to maintain and improve recreational sites.
- Evaluate ORV recreation opportunities and establish a system of designated routes.

G. Community Benefits

Goal: Provide opportunities for people to realize their material, spiritual, and recreational values and relationships with the forest.

Objectives:

- *Provide opportunities for local people to realize economic benefits from innovative contractual mechanisms and technologies focused on linking stewardship activities and community well-being.*
- *Pursue compensation of local workers at a state-average family wage or higher to accomplish ecosystem management.*
- *Design contracts to promote opportunities for year-round, long-duration, stable employment.*
- *Design unit product sales and service contracts to promote participation (e.g. bidding and contract awards) by local vendors, purchasers, and contractors.*
- *Promote a local business environment that can take advantage of the products and services of ecosystem management (e.g. small diameter and under-utilized species).*

Timber

The wood products industry has been a mainstay of the local economy since World War II. The Lakeview Federal Sustained Yield Unit was established in 1950 to maintain community stability by providing wood products firms in Lakeview and Paisley the exclusive right to bid on timber sales within 500,000 acres of the Fremont National Forest. During the 1980s, local mills bought and processed about 60 million board feet of federal timber per year. However, declining federal timber sales and other economic factors during the 1990s resulted in mill closures.

Currently, the Collins Companies Sawmill is the only sawmill operating in the area. The Collins Sawmill has 80 hourly employees, and about 100 total employees, and operates two shifts daily, markets permitting. The company has spent about $10.3 million in new capital equipment over the last nine years. Part of this investment, $6.8 million, was for a small diameter sawmill in 2007. This investment was possible because the Collins Companies obtained a 10-year Stewardship contract for timber sales and associated work within the Unit. The Collins mill processes about 60 million board feet of lumber annually, with about 70 percent being ponderosa pine and 24 percent white fir. About 15 to 20 percent is harvested from Fremont-Collins lands, with the rest from public and private sources. The Collins Companies owns and sustainably manages 47,500 acres of private timberland adjacent to the Fremont National Forest in Lake County. Collins is widely regarded as a timber industry leader in environmental stewardship. The Collins Company forests are one of the largest blocks of forest land in Oregon certified by the Forest Stewardship Council.

During the past decade, the Forest Service has sold a total of 87 million board feet (mmbf) of timber in the Lakeview Federal Stewardship Unit. The annual totals have ranged from a high of 21.7 mmbf in 2007 to nearly zero in 2001. During the first half of the decade, the timber sale program focused on post-fire salvage logging. Major salvage sales included Cub in 2003, Winter in 2004, and Grassy in 2005. Subsequently, the timber sales program shifted to “green” thinning projects, starting with Bull Stewardship and two Jakabe project sales in 2006. More recently, major stewardship thinning projects have included Burnt Willow and Trail in 2007, Abe in 2008, and Launch and Dent North in 2009.

LAKEVIEW FEDERAL STEWARDSHIP UNIT TIMBER SALES, 2000-2009

Year offered /awarded	Green (mbf)	Salvage (mbf)	Harvest Acres	Value in $/ccf
2000	**0**	**5,349**	**2,600**	**$23.05**
2001	**0**	**36**	**737**	**$13.50**
2002	**0**	**5,053**	**556**	**$64.54**
2003	**0**	**11,348**	**1,579**	**$58.79**
2004	**1**	**10,539**	**1,360**	**$6.09**
2005	**462**	**4,229**	**736**	**$36.20**
2006	**8,791**	**95**	**2,750**	**$53.43**
2007	**21,623**	**0**	**5,644**	**$17.22**
2008	**9,900**	**1,358**	**4,013**	**$26.28**
2009	**8,334**	**1**	**2,164**	**$2.21**
Grand Total	**49,111**	**38,008**	**22,139**	**$29.18**

Timber Guidelines:

- Design thinning projects to ensure they are marketable to local mills.
- Estimate potential long-term supply of small and medium-sized trees as restoration by-products.
- Evaluate additional agency resources and funding to prepare sufficient timber sales or stewardship contracts to accomplish needed restoration.
- Annually monitor and report statistics on the timber supply on the stewardship unit, including sold vs. planned, no bids, and green vs. salvage sales.

Biomass and Other Small Wood Utilization

The 2002 University of Washington study on the Fremont National Forest showed that to restore the Fremont National Forest to natural stand conditions and fire regimes would require an extensive thinning and under-burning program resulting in tremendous volumes of small diameter material. The only proven technology that could consume this large volume would be a biomass plant. Following this study the Governor made the Lakeview Biomass Project an Oregon Solutions project with Hal Salwasser, Dean of Forestry at Oregon State University, convener of the process. At the end of one year industry, agencies (local, State and federal), environmental groups and non-profits signed on to a declaration of cooperation to assist in moving the Lakeview Biomass project to completion. In 2009 the Governor again endorsed the project by making it an Oregon Way Project to compete for stimulus dollars.

However, biomass energy is less competitive in the market than the traditional fossil or hydro energy sources. The technologies for biomass fuels are relatively new and mostly in the prototype stage with little economic incentive for industrial production. A 2004 study in Washington State looked at biomass fuels (forestry residues, dairy industry wastes, and municipal solid wastes) and biomass technologies (combustion, gasification and anaerobic digestion). The report concludes, "Unless entities such as the USDA Forest Service were to make a long-term commitment (for example, for the life of a power plant) to supply a significant volume of forestry residues at a fraction of the cost of collection and transportation, a Yakima County biomass-to-energy project would be a significant gamble." With this in consideration, a 20-year MOU for supply was developed between the Forest Service, BLM, Lake County, DG Energy, The Collins Companies, Town of Lakeview, City of Paisley and Lake County Resources Initiative.

Following the 20-year MOU, the Forest Service developed a 10-year stewardship contract within the Unit and the Collins Companies successfully bid on that contract. The 10-year contract and 20-year MOU gave more of an assurance than had been seen in the past that there would be supply for the sawmill and biomass plant so these companies could justify their investments. Similarly, the BLM is currently issuing a new stewardship contract for the Lakeview District which will allow for multiple task orders to be issued over the next 10 years.

Knowing the poor economics for biomass, Lake County Resources Initiative contracted with CH2MHill to develop a business plan, complete preliminary engineering, and investigate the influence of carbon credits, energy credits, and Forest Service Stewardship contracts on the economics of a biomass plant. A fundamental point of agreement within the Lakeview Stewardship Group and the Lake County Resources Initiative is that a biomass plant must be a tool to meet the goals of the Unit and not an industrial facility that creates an unsustainable demand for resources. The State of Oregon Business Energy Tax Credit (BETC) and federal energy credits are key factors in making a biomass plant an economically viable enterprise.

Scientists differ on whether thinning to reduce uncharacteristically large fires is actually a carbon savings. The 2002 study by the University of Washington on the Fremont National Forest reported on the benefits of restoring natural stands on CO_2 storage in the forest, forest products, the displacement value of using biomass over natural gas, and product substitution. However, more recent research indicates that net carbon benefits from fuel reduction treatments are unlikely and will be small at best, since many treated acres will not subsequently burn while the treatment is still effective (Mitchell et al. 2009). Other research suggests that carbon benefits are most likely to be realized when treated stands are fire-prone and contain large fire-resistant trees, which is fully consistent with other objectives of this strategy (North et al. 2009). Lake County Resources Initiative is under contract with Winrock International under a program by the West Coast Regional Carbon Sequestration Partnership to help determine if there is a carbon savings from forest thinning to restore more natural fire events. Spring of 2010 will be the fourth year of collecting data.

One area that may be especially appropriate for the carbon market is tree planting following uncharacteristically large fires. The monitoring in the Unit has shown that there is virtually no regeneration in some areas following these large fires because of the impact on the soils. Since monitoring plots only go back 10 years, the duration of this condition is unknown, but tree planting would provide at least 10 years of carbon reforestation credits. This does not mean that the Lakeview Stewardship Group supports salvage logging; the group's priority is to have a steady green program.

Biomass Guidelines:

- Implement the 10-year Stewardship contract for a minimum of 3,000 acres of thinning per year within the Lakeview Federal Stewardship Unit and an additional 3,000 acres per year outside the Unit.
- Develop a 10-year Stewardship contract with BLM for 2,000 acres per year of Juniper treatment.
- The contracts should go to a biomass company investing in a plant located in association with the Collins Companies sawmill.
- If Congress passes a cap and trade bill on carbon emissions and recognizes forest management and preventing uncharacteristic large fires as methods of carbon emission mitigation, develop a second 10-year contract that would record, verify, monitor and sell carbon credits to reduce uncharacteristically severe fire events through meeting the Unit goals.
- Ensure that the size of the biomass plant is sustainable for the life of the plant and used as a tool to achieve this strategy's goals.

Non-Timber Forest Products

The LFSU provides many non-timber forest products to the community on a permit basis for non-commercial purposes. While the fees collected for these permits are not a significant source of revenue for the Forest Service, the benefit to the community is significant. From 2004 through 2009, public use permits were issued on the Paisley and Lakeview Ranger Districts for the following:

Public Use Permits Issued at Lakeview & Paisley Ranger Districts from 2004 through 2009		
	# of Permits	**Value**
Free Use Firewood	1,174	$19,554
Personal Use Firewood	2,210	$49,860
Commercial Boughs	14	$460
Commercial Christmas Trees	4	$765
Commercial Firewood	55	$5,170
Personal Use Christmas Trees	88	$8,265
Commercial Mushrooms	6	$200
Free Use Cones	2	$7
Free Use Limbs & Boughs	6	$101
Free Use Mushrooms	119	$1,744

Personal Use Post & Poles	131	$2,966
Vendor Christmas Trees	12	$1,530
Free Use Transplants	35	$441
Free Use Mountain Mahogany	2	$10
Plant Collection--Washington Herbarium	1	$20
Totals	**3,859**	**$91,094**

Key Issues

Issuing permits for non-timber forest products is generally compatible with Unit goals. For example, permits for harvesting pushed-down juniper complements juniper removal projects and provides a healthy benefit to the community. Issuing firewood permits helps remove unmarketable wood products from the forest. Harvesting of all these products helps meet the goal of "providing opportunities for people to realize their material, spiritual and recreational values and relationships with the forest."

Guidelines:

- Continue to issue permits for non-commercial personal use of non-timber forest products where compatible with ecological objectives.
- Promote environmentally responsible removal of non-timber forest products.

Grazing

Most livestock grazing on Lakeview Federal Stewardship Unit lands has occurred in the areas currently grazed, in a variety of forms, for over a hundred years. Typically during that time numerous grazing systems have been implemented along with accompanying range improvements. Stocking rates and seasons of use have been adjusted, and the timing, intensity, frequency, and duration of grazing have been continually fine tuned over time. More recently, further adjustments have been made on many allotments to provide for the needs of species listed under the Endangered Species Act.

Livestock production is an important industry in Lake County. The emphasis in livestock production has been based on the cow-calf operations. Unit lands are important because they provide high quality forage during the period that home pastures are growing or being harvested for hay. Many local ranch operations are dependent for some part of their yearly operation on lands within the Unit.

Currently, all or a significant part of 38 allotments are located in the Unit. About 33,900 AUM's (Animal Unit Months = a cow and calf for one month) are permitted every year within the Unit. This equates to about 5,600 head of adult livestock every year, assuming an average 6-month season of use. About 34 business or family ranching operations have grazing permits within the Unit.

Riparian areas are an important attribute of the Unit, providing important habitat for a host of fish and wildlife species as well as forage and water for cattle. Many of these riparian areas are vulnerable to damage from grazing. Accordingly, livestock use of these areas must be carefully managed.

Grazing allotments have been classified according to the level of intensity at which they are managed. These levels include intensive, deferred, and season-long grazing. Twenty-nine of the allotments in the Unit are managed intensively. Under such management, livestock are regularly rotated among pastures in coordination with different stages of plant growth. Four allotments are operating under deferred grazing systems. Under this type of system, livestock are not moved onto an allotment until plant growth has reached the stage of maximum nutrient reserve in the root system. Livestock are generally free to choose their own foraging areas unless constrained by topography and/or boundary fences. Season-long grazing is in effect on five allotments. Typically, livestock enter these allotments on a specific date in spring or summer and forage at random until removed at a specific date in fall, or when monitoring shows use standards have been met.

On thirteen of the allotments in the Unit, grazing of private land is done in conjunction with the owners' federal land permit. This "Private Land Permit" arrangement allows the private land owner flexibility in management and movement of livestock. Private land can be incorporated into grazing systems to provide proper management of plant growth.

Successful grazing management requires that standards and guidelines for allowable ("proper") use be established – i.e., a set of measurable benchmarks that, when reached, trigger moving livestock. Proper use is defined as a degree of utilization of current year's growth that if continued, will achieve management objectives and maintain or improve long-term productivity of the site (Society of Range Management 1979). For federal lands within the Unit, standards and guidelines have been established in the forest plan and modified in Biological Opinions as required by the Endangered Species Act. Of the thirty-eight allotments in the Unit, eighteen are under consultation Biological Opinions for Warner, Shortnose, and Lost River Suckers. Standards and guidelines vary from allotment to allotment, and pasture to pasture depending on the condition, trend, and goals for the various resources in the allotment/pasture. For example, a pasture with a riparian area that is functioning at risk with a downward trend would not be allowed as much use as a riparian area functioning at risk with an upward trend.

The frequency and intensity of monitoring varies depending on the condition of the resources to be monitored and the goals to be achieved for identified resources. More monitoring is done in pastures with less than desirable resource conditions and/or the presence of very sensitive resource conditions or issues such as Threatened and Endangered (T&E) species. Monitoring guidelines can be found in the Fremont Forest Plan, the Meadow Riparian Monitoring Guide produced by the Fremont National Forest in 1997, and the Biological Opinions for Warner, Shortnose, and Lost River suckers (May 1997) on file with the Fremont National Forest.

The goal of modern livestock grazing is to maintain or improve rangeland health. Rangeland health is the degree to which the integrity of the soil, vegetation, water and air, as well as the ecological processes of the rangeland ecosystem, is balanced and sustained. Integrity is defined as the maintenance of the functional attributes characteristic of a locale, including normal variability. In the case of livestock grazing lands within the Unit, health has mostly been defined as the condition of riparian areas as measured against desired future condition. Riparian areas have been described as the weak link in our arid ecosystem.

<u>Guidelines</u>

- Continue the use of modern grazing systems and grazing techniques within the Unit. As opportunity arises, convert or incorporate season-long grazing allotments to deferred/rotational grazing systems.
- Practice adaptive management. Make adjustments to grazing based on monitoring results.
- Further define rangeland health and the desired future condition for riparian areas in the Unit.

H. Forest Restoration Implementation and Economics

Introduction

It is the specific intent of the Lakeview Stewardship Group to chart new ground, develop holistic solutions, and establish a standard of excellence in the implementation of forest restoration work. Considering the Restoration Planning Overview and the other Key Issues of this strategy, an integrated approach to forest restoration is warranted. Restoration objectives, prescriptions, and equipment should be designed to integrate multi-resource objectives for forest vegetation, soils and water, road density, wilderness and roadless areas, recreation opportunities, and other forest values. Economic and contracting strategies and mechanisms should be designed to facilitate ecosystem restoration and capture the greatest benefit for the local economy.

Implementation Principles & Guidelines

- It is implicitly understood that management actions will likely have both short- and long-term effects on a compendium of forest resources and attributes. The decision to take action acknowledges that impacts will occur and tolerance of such impacts, expected and unexpected, positive and negative, will be necessary to make progress. Monitoring and adaptive management tools will be consistently used to assess the effects of management implementation and to make informed changes.
- Forest restoration prescriptions will be designed to achieve desired conditions, at the forest stand level, suitable for the habitat type present.
- Restoration prescriptions will accommodate existing forest plan and regional direction, unless such direction is modified as a result of acquiring new, scientific information and codified through the normal public and environmental review process.
- Restoration prescriptions will define soil and water protection standards in a performance-based manner at the forest stand level. Real-time Monitoring and Adaptive Management will be used to validate compliance and improve protection performance.
- Meeting the habitat needs of forest wildlife during management implementation will be defined in a performance-based manner. Monitoring will reveal effects and Adaptive Management will improve performance.
- Management implementation strategies and desired or suggested equipment configurations to be used will be designated based on integrated criteria of desired protection levels and economic opportunity, to effectively manage overall management costs and impacts.
- Management implementation strategies and equipment used will be integrated to allow for efficient and economical implementation of subsequent management actions to be performed.
- Trees harvested during forest restoration operations will be fully utilized consistent with Unit goals and objectives. This will include small diameter trees, downed wood and other previously underutilized material, all the while satisfying necessary fire risk reduction, soil structure protection, soil nutrient cycling capability and large woody debris for soil and habitat objectives.
- Local processing of derived raw materials and the use of local employment for forest management services will be strongly encouraged to foster the development of new, local, economic opportunities for wood products manufacturing and other businesses associated with forest restoration.

Logging Systems & Machinery

The availability and skillful use of appropriate logging equipment will be critical to achieving the restoration goals of the Lakeview Stewardship Unit. There is a huge disparity in actual soil impacts with different ground-based timber harvesting and wood extraction systems and equipment. Consideration of *how* the particular equipment systems are to be used and the level of operator skill, care, and attention to detail are critical factors in limiting adverse impacts. Different operators on the same machine can have disparate levels of impacts. This issue can be addressed with training and education workshops for forest restoration operators.

An example to illustrate the trade offs and attributes of different systems could be the consideration of building a temporary access road to reduce skidder travel distances to 1500', or the consideration of a forwarder extraction system, which would not need the additional temporary road and shorter travel distance to be cost effective. In this case, the expense of the temporary road and its subsequent negative impacts on soil productivity, water infiltration, etc., coupled with the expense of the skidder system, would be weighed against the additional expense of the forwarder system and no need for the expense or impacts of the temporary road.

Another example could be the desired underburning of the treated forest stand after designated trees have been removed. The use of a tree length harvesting system in this situation would necessitate that landing logging slash be returned to the forest, so that sufficient surface fuels were present to carry the underburn and to facilitate the return of nutrients from the cut trees' limbs and needles. In this scenario, it would make sense to use a different harvest method and equipment systems to reduce soil impacts (traveling back over the same ground again with the skidder), leave the needles and branches in the forest in the first place and to improve the economics of the overall operation.

With many of the anticipated forest restoration treatment areas in the Stewardship Unit, machinery and logging systems will need to be selected relative to the anticipated soil protection, road density, snag retention, tree removal, follow-up underburning, and nutrient retention guidelines. New, affordable machinery systems, different from those currently available with existing contractors in the Unit's geographic area, may be best suited to meet these objectives. Training, education, and re-tooling of the current contractor workforce may also be needed, as well as availability of financial assistance enabling local contractors to procure the new equipment systems and integrate these new systems into their businesses.

Actual choices of suitable timber harvesting and extraction systems should be made on a site-specific basis and should include specific consideration of the forest type, soil type, desired implementation prescriptions, desired snag density, follow-up prescribed fire, season of operation, existing road density and many other site and area specific parameters. Off-site impacts also need to be considered. For example: helicopter extraction does not require a high density road network, but because helicopters have to work at a very high extraction rate to be economical, the resulting volume of log truck traffic and the wear and tear, and erosion, on the road system may lead to other, negative environmental impacts.

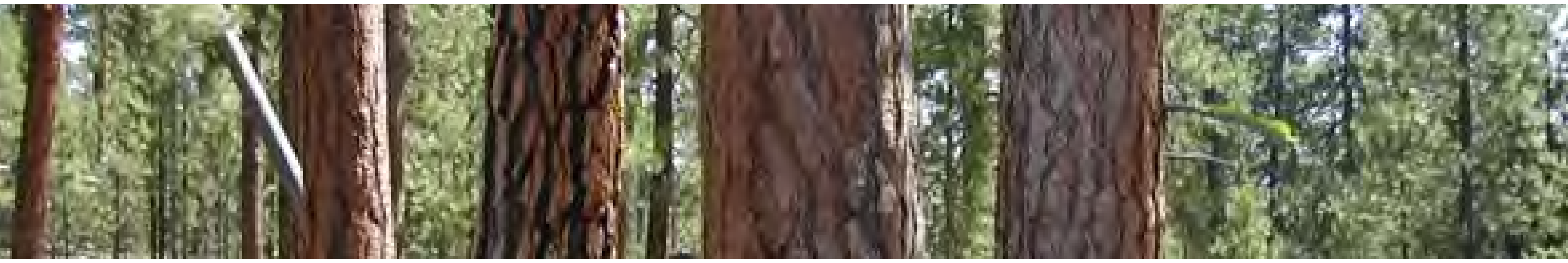
Many innovative developments are occurring with respect to relatively new machinery systems and the pairing of various machinery platforms. For example: the pairing of excaliners (excavators fitted with winch drums) and high capacity forwarders can negate the need for additional road networks, as would be required with conventional cable extraction systems.

With respect to salvage harvesting and extraction after wildfire events, the season of operation becomes the most critical aspect for consideration. Harvesting systems that can operate during frozen winter conditions (where they exist) and which do not require any new roads or road upgrades will likely have the least negative impacts on soil resources and potential additional erosion and subsequent sediment delivery to streams. This is a particular conundrum at the moment as analysis timeframes often negate the possibility of authorizing salvage harvesting the first winter season after a wildfire, when the additional negative impacts caused by the salvage harvesting will be at their most benign and the remaining economic value of the burned timber remains relatively high.

Helicopter extraction operations have few negative effects on soil and water resources and are a valuable salvage tool. However, they are limited in application, particularly as burned timber rapidly loses its economic value when springtime conditions arrive. Helicopter operations are also very hazardous in burned areas, requiring the removal of nearly all the burned trees, including the desirable snags, which provide a critical resource for many wildlife species.

<u>Logging Systems Guidelines:</u>

- Utilize an integrated approach to match logging systems to topography, road access, soil attributes, treatment prescriptions, and seasons of operation.
- Provide the financial and technical assistance necessary for local contractors to procure and operate new logging equipment appropriate for restoration implementation.
- Provide training and education workshops for forest restoration equipment operators to minimize negative impacts on soils and other resources.



Monitoring

V. MONITORING

Biophysical Monitoring Component

The purpose of inventorying and monitoring is to periodically collect direct information about the composition, structure and functional condition from hundreds of permanent plots located across the Unit. Direct information reduces assumptions and second-hand information about an area of the Unit and how it is performing. Such information supports adaptive and effective management. The Upper Chewaucan River drainage was chosen by the Lakeview Stewardship Group as the location to begin the biophysical monitoring, since it reflects many characteristics found across the Unit. Since May, 2002, the Fremont-Winema Resource Advisory Committee (RAC) has authorized Forest Service Title II funding to pursue the following objectives:

1) Inventory the critical ecosystem indicators across the 275 square mile watershed by establishing a large sample population of tenth-acre permanent plots.
2) Establish permanent plots throughout restoration project areas to monitor the effectiveness of the treatments over time.
3) Analyze the acquired data to determine the present condition of the Chewaucan and its trend toward health, given sufficient time to determine such trending.
4) Make a geographic information system (GIS) database, a narrative and methods employed to gather that data available to the Forest Service, the community and the general public through a website.
5) Perform surveys of specific ecosystem information needs requested by the Forest Service and report them to the Forest Service and the community.

An 8- to 12-member monitoring team is recruited annually from high school students and recent graduates in the Lakeview and Paisley communities. Generally two new high school students are added yearly as apprentices. On average 60 percent of the crew is in college or post college and 40 percent are in high school. Their training has been provided by Clair Thomas, past Lakeview High School science teacher and presently Natural Resource Coordinator for Tillamook School District #9. Richard Hart, forest ecologist and soil scientist, designed the original protocols and directed the monitoring effort through 2005. Clair Thomas began directing the monitoring effort in 2006. The administration of the project is provided by the Lake County Resources Initiative (LCRI), with Jim Walls as its executive director.

A selection of 35 indicators[*] was chosen to measure and record on more than 300 tenth-acre permanent plots spread across the Upper Chewaucan. More than 800 1/50-acre plots have been established and put into Landscape Management Systems (LMS) to model forest structure and behavior. Plots were established to seek answers to the questions about the effectiveness of restoration projects and the general health of the watershed. These questions are currently being answered. Many of the insights gained from these surveys have been included in this update of the Long-Range Strategy for the Lakeview Unit. The Forest Service, the community, and environmental organizations who have participated in the Unit's resurgence and reauthorization provided these questions.

The eight years of collected data is stored on a dedicated server in the form of a relational GIS database and narratives. The address is www.lcri.org/monitoring. With enough time and essential data, trends toward Unit health and treatment effectiveness can be identified, and adaptive measures can be implemented.

The data from the 35 indicators will soon be analyzed to determine which core biophysical indicators give us the best information and choose those to proceed with. This proposed reduction will allow the present team to establish permanent plots across the entire Unit. What has been learned from the 35 indicators will be extrapolated where appropriate to give an enhanced understanding of the data collected and analyzed from the rest of the Unit.

<u>Biophysical Monitoring Guidelines</u>

- Continue and build on the successes of the Chewaucan Biophysical Monitoring Project.
- The collaborative monitoring program should be spread across the whole Unit.
- Integrate Forest Service staffing and finances for monitoring to the extent feasible.
- Basic information about how the Unit functions has been skimpy, with historical data that is not easily retrievable. Thus, the Unit needs a databank that is accessible to anyone who has need of it.
- Continue the formal partnership created by the community and the Forest Service, through the RAC and the LCRI, that supports the monitoring program financially and by appropriate policy.
- Indicator information needs to be collected in a systematic and continuous basis across the whole Unit with regards to the restoration activities.
- The indicator data collection needs to be continued by a trained and paid crew whose membership is bonded to the landscape and the community.
- The biophysical monitoring program needs an advisory committee composed of community, agency and team members.

Socio Economic Status of Lake County

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[*] The monitored indicators cover the following: type and percentage of effective ground cover; vegetation species ID and populations; soil texture and chemistry; rhizosphere zone level, soil temperature and available moisture; soil compaction; stand structure (tree species, rates of growth, girth, stem health, canopy structure, down woody material, pathogenic activity); stream channel morphology; water chemistry; benthic macroinvertebrate feeding group inventory; and pebble counts performed. Each permanent plot is GPS identified, their coordinates measured to the nearest landmark, permanent tags installed and the plot's surface and surroundings are photo-documented.

The economy of Lake County is fairly typical of natural resource dependent counties in the Pacific Northwest. However, the county's geographic isolation poses special challenges. Although other counties with similar economic profiles have managed to diversify their economic bases, Lake County has continued to lag behind.

In a recent report by the Sonoran Institute entitled "Profile of the Rural Inland Northwest" Lake County was rated number 35 in a list of the most stressed rural counties in the Inland Northwest. This ranking comes from a composite of ratings comparing the 104 rural inland northwest counties on their placement in such indicators as unemployment rates, housing affordability, families living in poverty, educational attainment and employment change.

In order to get a better picture of Lake County's socio economic status consider the following economic statistics gleamed from the Profile of the Rural Inland Northwest:

- Percent Population Change 1970-2002 – 16% (25 out of 104)
- Long Term Employment Change 1970-2002 – 40% (24 out of 104)
- Short Term Employment Change 2000-2002 – 0.5% (36 out of 104)
- Annual Average Unemployment Rate 2003 – 10.4% (13 out of 104)
- Per Capita Income 2002 - $21,854 (43 out of 104)
- Families living in Poverty 2000 – 13% (12 out of 104)
- Adult Population with College Degree – 15% (47 out of 104)
- Housing Affordability Index 2000 – 195 (index of 100 is affordable) (101 out of 104)

The 2000 United States Census provides the following additional economic information:

- Employed Population Engaged in Agriculture, Forestry, Fishing and Hunting, and Mining – 20.4%
- Employed Workers in Private Industry - 54.8%
- Employed Government Workers – 28.1%
- Self Employed Workers – 15.6%

The 2000 United States Census reveals the following social information about Lake County:

- 2003 Estimated Population – 7440
- 1990-2000 Population Change – 3.3% (Oregon 20.4%)
- Persons with Disability Age 5+ - 1,519 or 21% of total population
- Civilian Veterans - 19.8%
- People Living in Same House as in 1995 – 55.1%
- People Who Lived In a Different County in 1995 – 25.2%
- People Living in a Home With English as the Only Language – 95.2%
- People Who Were Born Outside the United States – 3.4%
- School Enrollment (K-12) 1,497
- School Enrollment (College or Graduate School) 101

Although many factors contribute to Lake County's distressed socio-economic status none has a greater impact than the County's geographic location. Consider the relative isolation of Lake County. Lack of transportation alternatives are often cited as reasons that new businesses hesitate to locate in Lake County. The closest commercial airport to Lakeview is Klamath Falls, 90 miles away. The closest freeway access is at Medford, 170 miles away. In order for trucks over 60 feet in length to travel legally east to west on Highway 140, costly renovations will be required. Freight can travel to Alturas, California on Lake County's railroad, but capacity is limited and connections are not timely. Many rural counties that are experiencing economic vitality have a healthy tourism sector. Lake County, however, has not yet proved to be a tourism draw.

Construction of a minimum-security prison near Lakeview has provided a significant economic boost for the County. Since it opened in September 2005, the Warner Creek Correctional Facility has brought approximately 140 new jobs and an annual operating budget of $25 million.

Renewable energy development is a promising long-term economic opportunity for the Lakeview area. It became clear as work began on the Lakeview Biomass Project that Lake County sits in a very unique position for other renewable energy projects including wind, solar, hydro and geothermal. In 2006 the Town of Lakeview, City of Paisley, Lake County, South Central Oregon Economic Development District, Lake County Chamber of Commerce, the Oregon Renewable Energy Center at Oregon Institute of Technology (OIT) and Lake County Resources Initiative came together to form the Lake County Renewable Energy Working Group. Realizing all the renewable energy potential, the group set as their goal to be fossil fuel-free from an energy standpoint in five years. Since that time:

- in 2007 the Town of Lakeview completed feasibility studies for a small hydro project, a geothermal heating district and geothermal electricity production;
- the Surprise Valley Electrification Corporation and a local landowner are in the final stages of a feasibility for geothermal electricity production and a geothermal heating district;
- Nevada Geothermal has leased the Grump Geyser in Plush;
- Lake County is pursuing solar and wind in conjunction with the Oregon National Guard at the outdated Backscatter Radar Site in Christmas Valley;
- Lake County Resources Initiative (LCRI) is working with Obsidian Finance Group, LLC to install the State's largest solar farm in Christmas Valley;
- in 2007 the Lake County Chamber of Commerce held meetings throughout the county on renewable energy potential and out of these meetings a great interest developed from ranchers and farmers in ground source heat pumps, solar watering pumps and small on-farm wind generation.

As a result of all this interest, LCRI hired a Renewable Energy Director (RED) position to lead this effort, working with local units of government, industry and landowners in developing these renewable energy potentials and to achieve the vision of being "*Oregon's Most Renewable Energy County*." Bob Rogers, who helped establish the Oregon Renewable Energy Center at OIT, is working under contact to Lake County Resources Initiative to assist in developing these resources on an industrial scale, as well as for smaller businesses, homes and ranches. In 2009 LCRI developed a renewable energy implementation plan that would make Lake County a net exporter of renewable energy. In 2010 LCRI and others are already discussing a revision of that plan to double the original goals. LCRI is also completing a carbon footprint analysis of Lake County to determine whether it is possible for renewable energy to offset Lake County's entire carbon footprint.

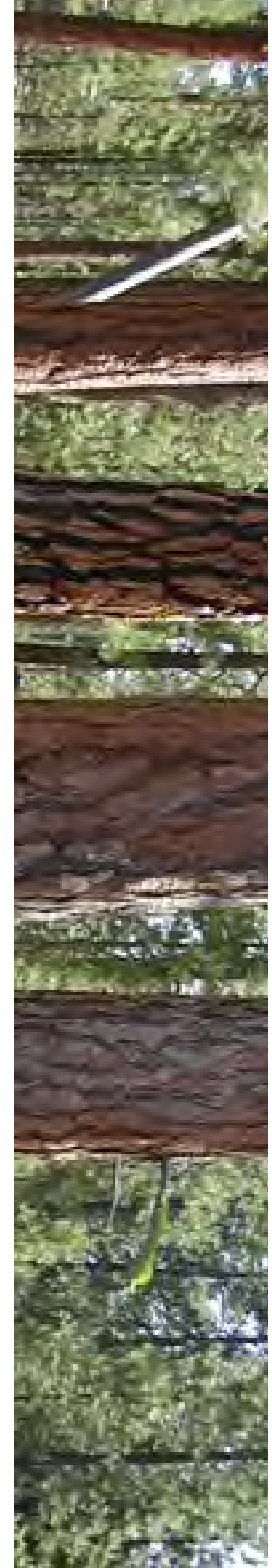
All in all, however, Lake County's socio-economic status is not likely to change rapidly. Natural resources in the form of timber and agriculture will most likely remain the economic mainstays of the County. With over 78% of Lake County's land base in government ownership, changes in federal land policies will continue to have a great impact on Lake County's socio-economic status.

Key Issues

- Decline in natural resource based jobs over the past generation has had a significant impact on the socio economic stability of Lake County's communities
- Inability to replace or improve natural resource based jobs has caused a significant decrease in the available workforce

<u>Socio-economic Monitoring Guidelines</u>

- Continue to work towards restoring natural resource based industry such as biomass plant, ten-year stewardship contracts, geothermal industries such as greenhouse and other agricultural based businesses.
- Utilize Oregon Economic and Community Development Department's annual review of County Economic Data
- Review and analyze upcoming Oregon State University Extension study of Lake County.
- Review and analyze 2010 census data when available.



Ten-Year Schedule Of Activities

VI. TEN-YEAR SCHEDULE OF ACTIVITIES

Vegetation and Fuels

The Forest Service considers the use of mechanical thinning and prescribed fire as its primary forest restoration tools, capable of accomplishing a broad range of resource goals beyond fuel reduction. Restoring fire to the landscape is needed to improve wildlife habitat and water flows, reduce insect and disease damage, protect large old growth trees, restore and reinvigorate forage plants and riparian vegetation, etc.

The Forest Service has been working toward fully integrating vegetation and fuels management into project planning, focusing on areas in greatest need of restoration and on using landscape scale treatments to make forests resilient to fire and other natural disturbances. The Forest Service has a 10-Year Vegetation Management Planning Schedule for the lands within the Lakeview Stewardship Unit. In total, the schedule includes 53,773 acres of commercial thinning treatment, 77,423 acres of fuels reduction with potential biomass removal, and 128,570 acres of prescribed fire. The agency anticipates that the schedule will be updated to reflect any changes due to funding, priorities and to incorporate new information (i.e. TNC Values Mapping) as it becomes available.

FOREST SERVICE 10 YEAR VEGETATION MANAGEMENT PROJECTS SCHEDULE

Fiscal Year	Unit	NEPA Planning Area	Project Name	Acres Commercial Treatment	Acres Fuels Reduction -Biomass	Acres Prescribed Fire
2010						
	LKV	Upper Thomas Creek	UTC Underburn	-	-	2,000
	LKV	West Drews	Dent North Stewardship	777	324	
	LKV	Abe	Abe Stewardship	590	439	
	LKV	Burnt Willow	Burnt Willow Stewardship	2,597	1,198	
	LKV	West Drews	Dent South Stewardship	1,110	1,110	
	LKV	West Drews	Stack Stewardship	1,400	1,400	
	PAI	Launch Fuels & Veg	Launch Stewardship	512	512	
	PAI	Jakabe	Kava Stewardship	395	395	
	PAI	Jakabe	Jakabe Plantation Thinning	-	352	
	PAI	Jakabe	High	202	202	
TOTALS				***7,583***	***5,932***	***2,000***
2011						
	LKV	West Drews	Straw Stewardship	1,500	1,500	
	LKV	Abe	Camp Creek Thinning	500	500	
	LKV	Abe	Abe Projects		700	2,700
	LKV	Strawberry Underburn	Strawberry Underburn	-	-	5,000
	LKV	Upper Thomas Creek	UTC Underburn	-	-	1,010
	LKV	N Warner Sage/Shrub	N Warner Sage/Shrub		300	200
	LKV	Booth Thin/Underburn	Booth Thin/Underburn		160	160
	PAI	Launch Fuels & Veg	LA Stewardship	1,750	500	
	PAI	Red Zone Safety	Mad	600	600	
	PAI	Red Zone Safety	Clear	440	440	
TOTALS				***4,790***	***4,700***	***9,070***

FOREST SERVICE 10 YEAR VEGETATION MANAGEMENT PROJECTS SCHEDULE (CONTINUED)

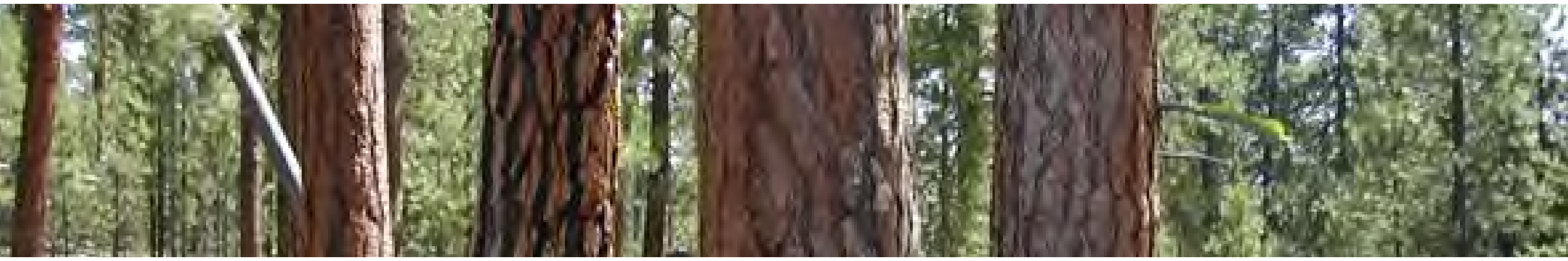
2012						
	LKV	East Drews	Green Dog Stewardship	1,300	3,500	
	LKV	Abe	Abe Projects	-	700	1,000
	LKV	Burnt Willow	Burnt Willow Projects	-	-	1,500
	LKV	West Drews	West Drews Projects	-	2,400	
	LKV	McCoin Underburn	McCoin Underburn	-	-	5,400
	LKV	Strawberry Underburn	Strawberry Underburn	-	-	4,000
	LKV	N Warner Sage/Shrub	N Warner Juniper	-	300	500
	PAI	Deuce	Day Stewardship	2,100	1,730	
	PAI	Jackabe	Trail Underburn	-	-	1,000
	PAI	Jackabe	Kava Underburn	-	-	1,000
TOTALS				***3,400***	***8,630***	***14,400***
2013						
	LKV	West Drews	Last Stewardship	1,500	1,000	
	LKV	West Drews	West Drews Projects	-	2,100	5,600

	LKV	Strawberry Underburn	Strawberry Underburn	-	-	6,700
	LKV	N Warner Sage/Shrub	N Warner Juniper	-	-	300
	LKV	Burnt Willow	Burnt Willow Underburn	-	-	1,500
	LKV	East Drews	Horseshoe Stewardship	1,000	2,800	
	PAI	Deuce	Senior Stewardship	2,100	2,841	
	PAI	Red Zone Safety	Cycle	1,200	500	
	PAI	Red Zone Safety	Ring	1,200	500	
TOTALS				***7,000***	***9,741***	***14,100***
2014						
	LKV	West Drews	Hay Stewardship	1,400	1,050	
	LKV	West Drews	West Drews Projects	-	4,400	10,000
	LKV	N Warner Sage/Shrub	N Warner Juniper	-	-	500
	LKV	Burnt Willow	Burnt Willow Underburn	-	-	2,000
	LKV	Camas Horse	Camas Horse Stewardship	1,800	6,000	
	PAI	Deuce	Drill Stewardship	2,100	1,730	
TOTALS				***5,300***	***13,180***	***12,500***
2015						
	LKV	N Warner Sage/Shrub	N Warner Juniper	-	-	500
	LKV	West Drews	West Drews Underburn	-	-	5,000
	LKV	East Drews	East Drews Underburn	-	-	5,000
	LKV	Wild Dry Rock	WDR Stewardship	3,600	7,700	
	PAI	Deuce	Shoe Stewardship	2,100	1,730	
	PAI	Launch Fuels & Veg	LA Underburn	-	-	1,000
TOTALS				***5,700***	***9,430***	***11,500***
2016						
	LKV	Muddy Cottonwood	MC Stewardship	2,000	3,500	
	LKV	West Drews	West Drews Underburn	-	5,200	5,000
	LKV	East Drews	East Drews Underburn	-	-	10,000
	PAI	Launch Fuels & Veg	LA Underburn	-	-	1,000
	PAI	Deuce	Camp Stewardship	2,100	1,730	2,000
	PAI	Shake/Merritt	Shake Stewardship	2,600	400	
TOTALS				***6,700***	***10,830***	***18,000***

FOREST SERVICE 10 YEAR VEGETATION MANAGEMENT PROJECTS SCHEDULE (CONTINUED)

2017						
	LKV	Crooked Mud	CM Stewardship	2,600	4,350	
	LKV	Upper Thomas Creek	Thomas II Stewardship	1,800	3,100	
	LKV	East Drews	East Drews Underburn	-	-	5,000
	LKV	Camas Horse	Camas Horse Underburn	-	-	5,000
	PAI	Launch Fuels & Veg	LA Underburn	-	-	1,000
	PAI	Deuce	No Name Stewardship	1,600	1,250	2,000
TOTALS				***6,000***	***8,700***	***13,000***
2018						
	LKV	Deep	Deep Stewardship	2,500	2,700	
	LKV	East Drews	East Drews Underburn	-	-	5,000
	LKV	Camas Horse	Camas Horse Underburn	-	-	5,000
	LKV	Muddy Cottonwood	MC Underburn	-	-	5,000
	PAI	Deuce	No Name Stewardship	1,300	730	2,000

TOTALS				***3,800***	***3,430***	***17,000***
2019						
	LKV	Camas Horse	Camas Horse Underburn	-	-	5,000
	LKV	Muddy Cottonwood	MC Underburn	-	-	5,000
	LKV	Crooked Mud	Crooked Mud Underburn	-	-	5,000
	LKV	Horse Whiskey	Horse Whiskey Stewardship	2,000	2,600	
	PAI	Deuce	Deuce Underburn			2,000
	PAI	Baja	Baja Stewardship	1,500	250	
TOTALS				***3,500***	***2,850***	***17,000***
10-YEAR TOTALS				***53,773***	***77,423***	***128,570***



Appendix A

APPENDIX A: GOALS AND OBJECTIVES OF UNIT

1) Sustain and restore a healthy, diverse, and resilient forest ecosystem that can accommodate human and natural disturbances.

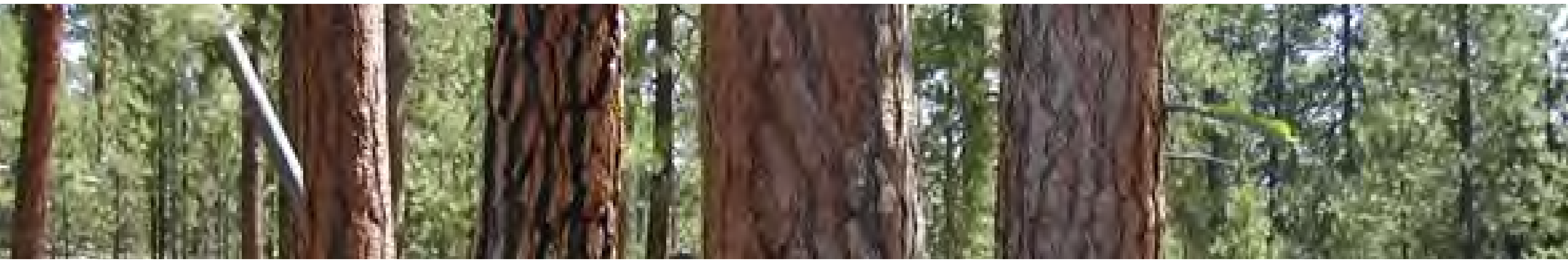
- Restore stand-maintenance fire regimes where they historically occurred.
- Maintain and restore habitat for focal species.
- Sustain and restore healthy soils.
- Restore forest conditions that approximate historical species composition and stand ages.
- Eliminate, where possible, and control the spread of invasive, non-native species (especially noxious weeds).

2) Sustain and restore the land's capacity to absorb, store, and distribute quality water.

- Manage upland vegetation to maintain and restore water and moisture absorption, retention, and release capacity over time.
- Reduce road density and improve remaining roads to minimize impacts on water quality and flow.
- Maintain and improve aquatic and riparian habitat for native species.
- Lower stream temperature and sediment loads.
- Improve biophysical structure of soils.

3) Provide opportunities for people to realize their material, spiritual, and recreational values and relationships with the forest.

- Provide opportunities for local people to realize economic benefits from innovative contractual mechanisms and technologies focused on linking stewardship activities and community well-being.
- Pursue compensation of local workers at a state-average family wage or higher to accomplish ecosystem management.
- Design contracts to promote opportunities for year-round, long-duration, stable employment.
- Design unit product sales and service contracts to promote participation (e.g. bidding and contract awards) by local vendors, purchasers, and contractors.
- Promote a local business environment that can take advantage of the products and services of ecosystem management (e.g. small diameter and under-utilized species).
- Protect and maintain areas of cultural significance within the forest.
- Improve opportunities for people to fish, hunt, and view nature.
- Promote environmentally responsible recreation.



Appendix B

APPENDIX B: METHODS TO ASSESS OLD GROWTH ACRES IN THE LAKEVIEW STEWARDSHIP UNIT

Gradient Nearest Neighbor data was compiled in treelists from the master tree list database Lemma_data.mdb were evaluated using SPMCDBH compute function in FVS.
For each tree in the list the following attributes were calculated:

1. Trees / Acre (TPA)
2. Percent Cover (Cover)

The TPA values were then summed for each species and each size class. Cover by species and size class was summed using the cover extension to FVS.
In addition, Total Cover for all trees regardless of species or size class was estimated for the density class analysis.
Note the cover estimates by species and size class do not equal total cover for the plot which was calculated summing all trees per plot. This is due to the random overlap built into the cover extension.

Species Composition (Seral State)

1. For each Plant Association Group (PAG) rate every possible species (all species in the tree dataset) as shade tolerant or shade intolerant.
2. Sum the cover of shade tolerant vs. shade intolerant species.
3. If shade intolerant relative cover is >75% then Seral State is Early Seral (1)
4. If shade intolerant relative cover is between 25-75% then Seral State is Mid Seral (2)
5. Shade intolerant relative cover is <25% then Seral State is Late Seral (3)

Size Classes (Structure Stage)

1. 2 sets of size classes were evaluated for each pixel.
2. The 1st set has 5 classes and was used to compare to local HRV estimates for each state:
   1. Grass/Forb/Shrub
   2. Seedling/Sapling (.1 - 4.9” dbh)
   3. Pole (5 - 9.9” dbh)
   4. Small (10 – 20.9” dbh)
   5. Large (21+” dbh)
3. The 2nd set has 7 classes and was developed primarily for wildlife habitat analysis. This set also matches the IMAP size classes.
   1. Grass/Forb/Shrub
   2. Seedling/Sapling (.1 - 4.9” dbh)
   3. Pole (5 - 9.9” dbh)
   4. Small (10 -14.9” dbh)
   5. Medium (15 -19.9” dbh)

6. Large (20 – 29.9" dbh)
7. X-Large (30+" dbh)

The size classes for each set of classes were evaluated from the largest size classes down to the smallest. Large and X-Large classes were tested 2 times.

1. If canopy cover of the X-Large class is the greatest cover by % then class = 7 else if the TPA for the X-Large class > the threshold in the R6 Interim Old-Growth definitions for the PAG then Class = 7.
2. If canopy cover of the Large + X-Large class is the greatest cover by % then class = 6 else if the TPA for the Large + X-Large class > the threshold in the R6 Interim Old-Growth definitions for the PAG then Class = 6.

The Medium – Seedling/Sapling classes were evaluated based on the largest class with a plurality of cover.

3. If the Size Class is not Large or X-Large, then cover of the Large and X-Large are added to first the Medium class and tested for plurality of cover. If Plurality is medium then Class = 5
4. If Size class is not Medium then cover of the Medium + Large + X-Large are added to the Small class and tested for plurality of cover. If Plurality is small then Class = 4.
5. If Size class is not Small then cover of the Small + Medium + Large + X-Large are added to the Pole class and tested for plurality of cover. If Plurality is pole then Class = 3.
6. If Size class is not Pole then cover of the Pole + Small + Medium + Large + X-Large are added to the Seed/Sap class and tested for plurality of cover. If Plurality is Seed/Sap then Class = 2.
7. Total tree cover < 10% = Class 1

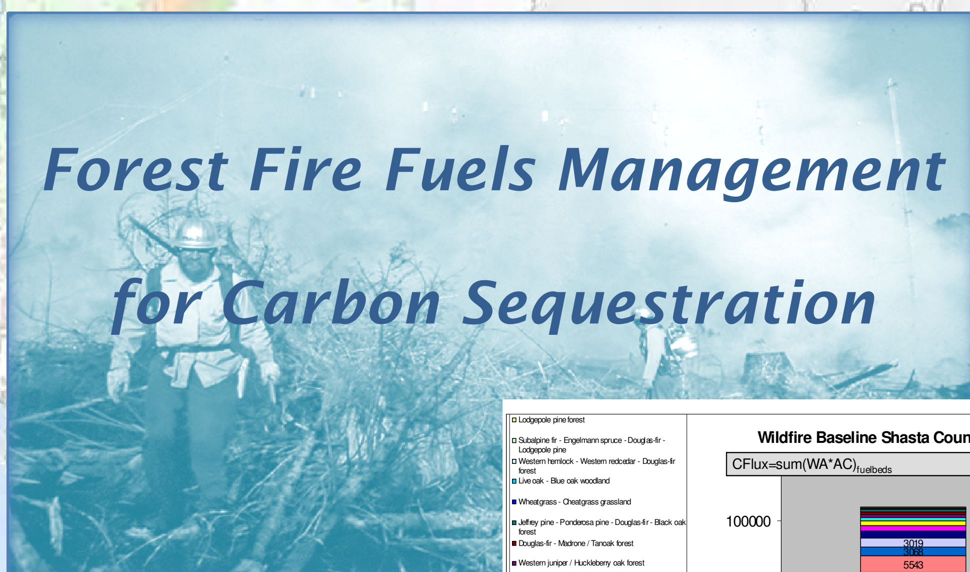
The Density Class is based on a total cover class threshold for each PAG. This threshold changes from 25% in the Juniper and Dry PP PAGs to 55% cover in the Moist Mixed Conifer and Mountain Hemlock PAGs. If the total cover is greater than or equal to the threshold then Density Class = 1 Else if the Cover is less than the threshold Density Class = 2.

APPENDIX C:
Forest Fire Fuels Management for Carbon Sequestration

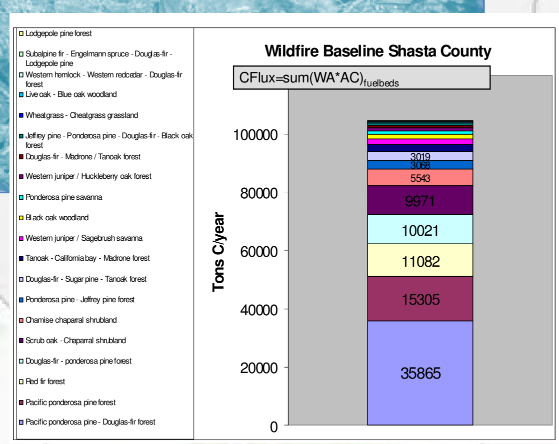
FINAL REPORT

April 19, 2008

DRAFT PROTOCOL FOR BASELINE FIRE EMISSIONS



Forest Fire Fuels Management for Carbon Sequestration



To: WINROCK International

Sandra Brown and John Kadyszewski, Co-Principal Investigators

By: DV (Sam) Sandberg

Sam's FireWorks

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Forest Fire Fuels Management for Carbon Sequestration

I Background

Objective

The objective of this assessment is to conceive a transportable methodology for establishing baseline fire activity and carbon emissions from forest fires and prescribed fires attributable to or affected by fuels management. The intent is to provide a dynamic current and future baseline of expected carbon loss from the un-treated ownerships from which to compare actual or expected future emissions from the treated ownership so that credit for carbon sequestration attributable to the management may be claimed. Context is provided by applying the baseline estimates to a trial demonstration in mixed conifer forests on selected ownership in California. Issues related to the tracking, accounting, and prediction of Carbon offsets are explored and discussed.

The central thesis of this analysis is that it is impossible to directly measure either a baseline or change over time for any area less than many tens of millions of areas. Some form of modeling will be necessary to agree on the expected annual area burned by wildfire or to assess the difference in fire risk over time or as the result of fuels treatment. Wildfire is episodic and rare, with less than a ten percent chance to visit any area within any decade, but certain within centuries. Carbon offsets for fuels treatments will necessarily be gained by demonstration, using agreed-to modeling protocols, that the risk of greenhouse gas (GHG) emissions over time from wildfires plus the sum of emissions from treatments and decomposition, minus the sum of sequestration due to growth, carbon allocation, and wood utilization are expected to be less with treatment than without treatment. The operative word is “expected”, so it is necessary to agree on how to model the effects of fuel treatment on future a) fire risk, b) fire severity, c) ecosystem response, and d) utilization.

This report will focus on treatment of forest fuelbeds and on the influence of altering the physical characteristics of fuelbeds on expected wildfire fire risk (probability of annual occurrence) and severity (GHC emissions). The direct effects of fuel treatments, including prescribed fires, as emitters of GHG’s is easily predicted by using emission models developed for air pollutant emission inventories. (Anderson et al 2004). Effects on decomposition rates, ecosystem response, and utilization are being addressed by others.

Two modeling approaches are possible to establish the current baseline (untreated) risk of fire: 1) calculating a baseline by adjusting from a large reference area to a smaller project area based on comparisons of the risk-causing biophysical characteristics of the two areas and calculating expected treatment effects by a similar comparison of before- and after-treatment fire risk, or 2) employ an intensive, site specific, deterministic fire behavior modeling for the current landscape and alternative futures by utilizing traditional fire management decision support tools such as FLAMMAP (Stratton 2004); This analysis will employ first modeling alternative, relying heavily on the Fuel Characteristic Classification System (FCCS) by Ottmar and others (2007). We believe it has the advantage over the 2nd by being more transportable, scale-independent, and less dependent on subjective expert judgment as an input.

Authority

This assessment is made by David Sandberg, sole proprietor of *Sam's FireWorks*, under contract with Winrock International and with contributions from USDA Forest Service Research. The work is done under the auspices of West Coast Regional Carbon Sequestration Partnership (WESTCARB), led by the California Energy Commission, one of 7 US Department of Energy regional partnerships with the goal of determining the best approaches to capture and permanently store greenhouse gases contributing to climate change. These government/industry partnerships are working to develop technologies, approaches and infrastructure for carbon capture, storage, and sequestration in both terrestrial and geologic systems.

Winrock International is leading WESTCARB terrestrial sequestration efforts. Terrestrial pilots are initially taking place in Shasta County, California and Lake County, Oregon, though opportunities will also be identified in Washington and Arizona. Activities include afforestation of rangelands, improved management of forest fuels to reduce emissions from wildfires, biomass energy, and conservation-based forest management. Overall objectives are to quantify emission reductions/sequestration attributable to each activity; gather information on costs and benefits to landowners; design measurement, monitoring and verification methods; evaluate the practicality of existing reporting protocols to capture verifiable reductions at reasonable cost to landowners and carbon credit buyers; explore questions of market validation for terrestrial activities; and evaluate environmental benefits.

The USDA Forest Service Pacific Northwest Research Station - Pacific Wildland Fire Sciences Laboratory/FERA Team is a key partner in this effort. David Sandberg, a private consultant and scientist emeritus representing FERA, has three decades of experience in air pollutant emissions inventory from fires and in characterizing fuelbeds, fuel consumption, and carbon emissions from fires; and is attempting to apply that experience toward the estimation of carbon baselines and project benefits for forests and fuels management.

Carbon offsets to motivate sequestration

Carbon offsetting is the act of mitigating greenhouse gas emissions by increasing carbon sequestration. Healthy forests sequester carbon as they grow biomass in durable pools such as tree boles and roots, so tree planting to replace shorter-lived vegetation is the most well-known example of a management practice that offsets emissions. Most newly-established temperate or tropical forest ecosystems continue to accumulate carbon for several decades to several centuries, depending on species composition, until they become "carbon-neutral" when mortality and decomposition rates approximately equals photosynthetic rate. Boreal forests are an exception, because the slow rate of decomposition promotes underground carbon storage that can extend sequestration for millennia. Thereafter, the system no longer sequesters carbon at a higher rate than the grassland or scrubland it replaced but it represents the one-time creation of a carbon store represented by total biomass (living and dead; above and below ground) as long as it remains a mature forest.

Harvesting live trees and utilizing the biomass in durable products such as construction materials delays decomposition for many decades and, if the harvested trees are replaced with new growing stock, sustains the forests' ability to accumulate carbon. So the true measure of the carbon store from managed forests would include the carbon sequestered in all wood products. If biomass is removed and converted to energy that reduces consumption of fossil fuels, an offset is accomplished by replacing many thousands of years of carbon formation while maintaining active sequestration by the remaining live biomass.

Fire plays an important role in determining the composition, productivity, and sustainability of most wildland ecosystems. Because fire is only one of many interacting ecological processes, managing fire to reduce carbon emissions is not as simple as preventing or suppressing fires. In fact, fire can either increase or decrease the emission of greenhouse gases over a decade or longer period by influencing other pathways of carbon sequestration and biogenic emissions.

Most wildland ecosystems, with the notable exceptions of boreal and bog ecosystems, do not forever sequester carbon from the atmosphere. Rather, they store carbon in structures during a grand period of growth and development that may last a few years (in grasslands) to a many decades (temperate forests) before mortality and decomposition roughly equals growth and the system becomes carbon neutral. Depending on climate (i.e. moisture and temperature regimes), the biomass directly consumed in mild to moderately severe fires would have decomposed and emitted roughly the same amount of greenhouse gases over those time periods as fire. Fire, by producing some long-lasting charcoal from woody debris and by charring large down logs and stumps, can even slightly reduce future decomposition rates. But all in all, the greatest effect of fire in stable temperate systems in to advance the timing of carbon emissions by a decade or two without substantially changing the carbon balance over time.

The measure of the effect of fires on carbon sequestration rates and storage depends almost entirely on the effect of fire on the health and structure of the mature forest that results after fire, rather than on the emissions or vegetation mortality from fire. Forest fires, in an over-simplistic view, are an anathema to carbon sequestration because they "destroy" forests, consume biomass and sequestered carbon, and emit greenhouse gases. It has been repeatedly proposed that preventing or suppressing forest fires could be credited as a carbon offset. In a few cases, it is true that severe forest fires do consume a significant fraction of living biomass or convert an ecosystem from a forest to a system that supports less standing biomass or even a system with a less productive system that for centuries will store carbon at a slower rate. Or, in boreal systems, create a warmer microclimate where below-ground carbon storage is lost. But the overwhelming fraction of biomass consumed in forest fires is from the accumulation of forest floor and dead fuels that would have otherwise released carbon dioxide as it decomposed over the next decade or two. So the actual effect of forest fires is to advance the release of those emissions by a few years. Tree mortality caused by fire is rapidly replaced in roughly equal measure by regeneration and growth of younger trees or by concentration of growth on the remaining large trees. Less severe fires, such as low-intensity fires in fire-dependent ecosystems of the Western United States, typically improve forest health and eliminate competing undergrowth, effectively transferring carbon stores from shorter-lived species to the boles and roots of trees.

Fuels management, for the purpose of reducing the frequency, size and severity of wildfires and a practice that may also yield useable biomass, has increased dramatically in the past decade on public lands. The increase in costly and destructive "mega-fires" generally attributed to climate change and decades of fuels buildup resulting from prior fire suppression has provided the incentive to invest heavily in restoring forest structure and fuel loading to sustainable levels. Dead biomass loading is almost always either generated through forest stand management or is consumed by fire by prescribed-burn treatments. In any case, fuels management advances either the short-term decomposition or the consumption of biomass in comparison to the unmanaged condition. Whether the advanced emissions or decomposition are offset by increased sequestration depends largely on two secondary effects of fuels management: 1) was the long term health (i.e. sequestration) of the forest ecosystem improved? and 2) was the eventual occurrence of wildfire or other forest disturbance either delayed or made less severe?

Accountability systems for GHG emission baselines

Widely accepted principles have been published for accountability systems for Project Baseline Scenarios for Greenhouse gas emissions (World Resources Institute 2005), In a sense parallel to the development of emission reduction systems for air pollutants over the past four decades, accountability systems based on these principles apply most readily to industrial and transportation sources for which a reasonably constant pattern of emissions can be inventoried and used as a baseline from which to measure future reductions. The obvious and standard methodology is to measure emissions, or inventory parameters thought to be reliable parameters to estimate emissions, over a period of years and simply project the average GHG emissions forward as a constant baseline for comparison to future inventories. Unlike air pollution baseline emissions, however, a GHG emission baseline is a forward-looking and hypothetical estimate of "what would have happened in the future" in the absence of the opportunity to mitigate climate change by offsetting emissions.

GHG emission baselines for Wildland Fire

The emissions baseline for wildfires is the area (acres) that would burn in the absence of a carbon project multiplied by the fuel loading (tons/acre) multiplied by the proportion of fuel consumed by fire (tons/tons) greenhouse gas emissions, or "GHG emission factor" (tons/tons) from each ton of fuel. Simplistically,

$$WGHG_{wildfire\ emissons}^{annual\ basline} = WA_{wilfire\ \ area}^{annual\ baseline} \times WF_{fuel\ load} \times WC_{\%Consumed} \times EF_{CO2}$$

Where

$$WA_{wilfire\ \ area}^{annual\ baseline} = PA_{project\ area} \times W\%_{wilfire\ \ area\ burned}^{annual}$$

Emission Factors, EF, for greenhouse gases are the most certain term in the equation. Forest fuels almost uniformly contain about 50% carbon (although rotten material can be as low as 35-40% carbon). About 95% of the carbon is released as carbon dioxide and a small quantity released as methane, carbon monoxide, or other greenhouse gases; so it is reasonable to apply an emission factor of about 1835 tons of CO2 per ton of fuel consumed. About 1-2% of the carbon in biomass is left behind as charcoal, sequestered for centuries in that form.

Fuel Consumed, WC, by fires can also be predicted with considerable accuracy on the basis of fuel moisture content at the time of burning. Several fuel consumption models have been published and are in routine use by fire managers.

Fuel load, WF, can range from a fraction of a ton per acre in grasslands to 100 or more tons in forests. Although highly variable, it is measurable directly in the field or estimated from vegetation cover, bioclimatic region, and qualitative description of the biophysical environment using the Fuel Characteristic Classification System, FCCS (Ottmar et al 2007). Forest fuelbeds are complex mixtures dead woody debris on the forest floor, plus a surface layer of moss, lichens, and recently fallen litter, a deeper layer of partially decomposed ground fuels that may burn under dry conditions, low non-woody vegetation, and shrubs (Riccardi and others 2007). In severe wildfires, tree branches and canopies are also significant components of the available fuel (Sandberg and others 2007a). Modeling biomass consumption, GHG emissions, or decomposition cannot be done with one measure of fuel load, but requires the combination of several algorithms that consider the entire fuelbed complex.

The natural (i.e. in the absence of fire management) fire return interval, i.e the inverse of fire risk, both depends upon and expresses itself in the vegetation cover type, and ranges from a year or three in some grasslands to centuries in some forest types. In much of the fire-dependent conifer ecosystems of the West, natural fire return interval would be on the order of 10-25 years, meaning that 4-10 percent of the forest lands would be visited by fire each year. But fires in the Western United States now burn about one-half of one percent per year, suggesting that fire control is approximately 90 percent effective at reducing area burned.

Wildfires are quasi-random, episodic events subject to influence to some extent by fuels management but also to a myriad of intrinsic ecosystem characteristics, weather conditions, ignition probabilities, and the influence of prevention and suppression activities. Consequently, it is extremely difficult to predict what would happen in the absence of fuels management or to assess the marginal effect of increased fuels management. Expected wildfire area burned, WA, is nearly impossible to measure directly.

Trends in wildfire area burned are difficult to establish because of the extreme inter-annual variability. It is simply impossible to measure the difference in fire frequency on any area smaller than a very large bio-region because any local trend is washed out by chance. Attempts have been made to measure the trend in area burned in the United States or other large regions such as Alaska or boreal Canada and even on those large areas the trends are difficult to establish. Nielson and Lenihan (2004) observed a very modest downward trend between 1960 and 1985 in the contiguous United States and a sharp increase (432 thousand acres per year) between 1991 and 2003 that could be due to climate change and or fuel buildup (figure 1). The data were used to tune their simulation model of area burned, which suggests that fire management has excluded 7/8 of natural fire risk.

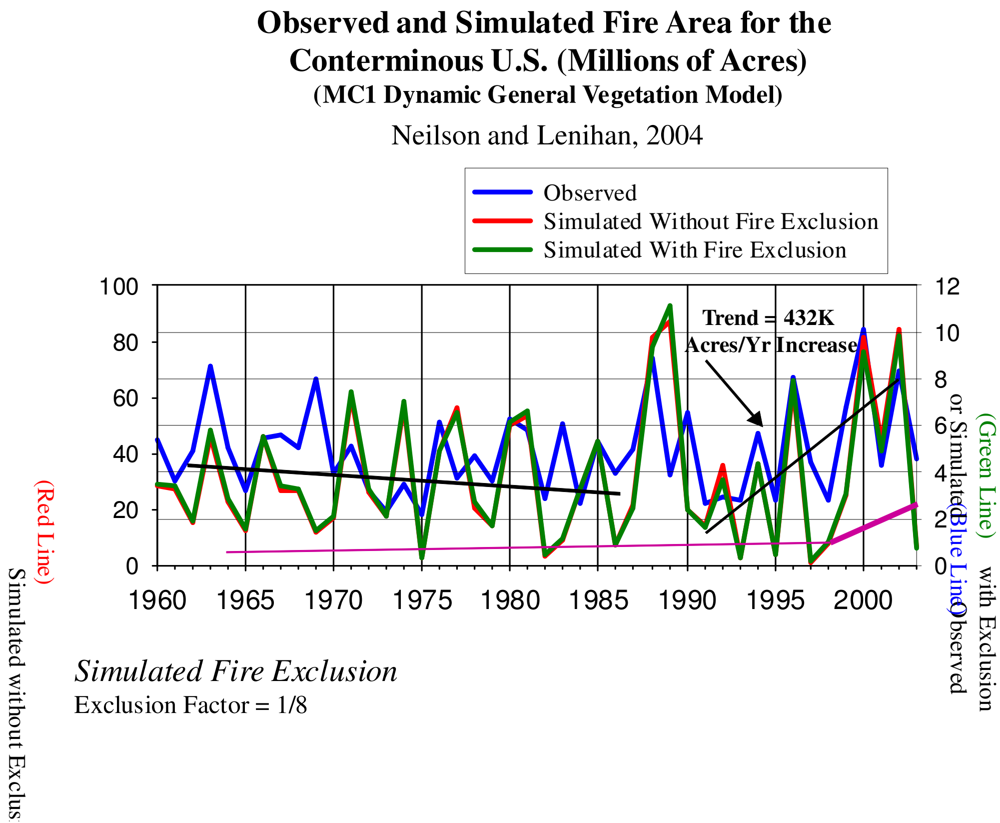


Figure 1. Increase in burned area observed and simulated by Neilson and Lenihan (2004)

Fuels Management, Fire Occurrence, and Fire Severity

Land management agencies and land owners in the United States spend several hundred million dollars per year treating forest fuels to reduce fire occurrence and severity. The effect on area burned is uncertain in part because total area burned and the number of very large fires continues to trend upwards, probably due to climatic change. It is taken on faith that the upwards trend would be even greater in the absence of fuels management, but quantitative proof has been elusive.

Obviously it is easier to suppress fires where fuel loadings and fuel continuity have been altered by fuel treatment, and the severity (biomass consumed and environmental impacts) of those fires is lowered. It is possible to accurately predict the change in fire behavior, biomass consumption, carbon flux, and air pollutant emissions per unit area that result from fuel treatment, but attempts to quantify reduction in burned area have been frustrating.

Central to our approach is our conclusion that annual area burned by wildfire cannot be reliably observed on any small area, i.e. smaller than a state or bio-region. It would be even more impossible to measure the change in fire area burned over any period of time shorter than several decades.   So, there is no hope of establishing an area burned (or carbon flux) baseline on a project area smaller than tens of millions of acres or a period of less than 30 years. The standard practice of measuring carbon flux or the level of activity for a greenhouse gas emitting activity and re-measuring carbon flux at intervals of 5-10 years is not a useful model for evaluating the effectiveness of fire or fuels management efforts.

Instead, some form of modeling must be employed to calculate a baseline for wildfire area burned and carbon flux, and the same form of modeling will be necessary to predict or re-calculate burned area and carbon flux in future decades with and without fuel treatment. That modeling could be done by deterministically simulating fire behavior under assumed weather, fuels, and management scenarios on every "fireshed" in a project area. Federal land management agencies are currently attempting to demonstrate that type of modeling in several areas including parts of the Sierra Nevada region of California.

An alternative approach is presented here that will be to establish a Large-Area historic baseline for wildland fire area burned, and then to adjust the baseline to the smaller Project Area based on differences due to such factors as a) Inflation of wildfire area burned over time, b Vegetation cover distribution, and c) Fuelbed characteristics. It may be possible in the future to also adjust for regional differences in d) Fire Weather, e) Ownership and management, and f) Social and ecological context.

II. DRAFT PROTOCOL for establishing GHG emission project baselines for Wildland Fire Carbon emissions from wildland fire

Step 1—Establish a Historic Large-Area (Reference Area) Burned Area Baseline:

$HFRisk_{ref}$ = Historic Annual Area Burned (in Large Reference Area, A/yr)/Large Reference Area (A)

a) Select a reference area, such as a State, Eco-region, Climate Zone, or other large area that includes the Project Area that has a reliable long history (20+years) of fire occurrence records, including fire size.
b) Compute a 10-year (or other period of between 5 and 20 years) running average of annual burned area. Compute the coefficient of variation of the average area burned, which will represent the minimum standard error of the absolute baseline area burned estimate.
c) Try different combinations of alternate Large Areas and history time periods to attain a satisfactory (or most accurate) historic baseline.

Step 2—Inflate Large-Area Baseline to account for wildfire increases

$$TimeHFR_{ref} = HFRisk_{ref} \times 1.007^{(analysisyear - historicbaselineyear)}, where$$

$TimeHFR_{ref}$ = Time-inflated historic fire risk (1/yr)

1.007=Default annual area-burned inflation factor

a) Inflate wildfire burned-area baseline to current year and future years using annual inflation rate of 0.5-0.9%, or other more applicable value, if known.
b) Adjust the wildfire risk, using other management and sociological factors, if quantifiable.

Step 3—Compare Large-Area Baseline to Project Area Fuelbed or Vegetation Cover:

$$PArea_{i.ref} = Area_{i.ref} \div \sum_{i=1}^{n} Area_{i.ref}$$

a) Determine the area covered by FCCS fuelbed or vegetation cover type, for which historical data or an algorithm exists that enables one to establish the relative fire risk for each fuelbed or type.
b) Using the FCCS mapping capability (McKenzie et al 2007) or other spatial classification of fuelbed or vegetation classification, determine the proportion of area covered by each class in candidate Large (reference) Areas.
c) Using the same classification, determine the proportion of Project Area covered by each class in the Project Area.

$$PArea_{i.project} = Area_{i.project} \div \sum_{i=1}^{n} Area_{i.project}$$

$PArea$ *is the proportion of the total area in either the Large Area* (ref) *or Project Area* $(project)$ *covered by FCCS Fuelbed i.*

$Area_{i.ref}$ = Area of FCCS Fuelbed i or Vegetation Type i in Reference Area

$Area_{i.proj}$ = Area of FCCS Fuelbed i or Vegetation Type i in Project Area

Step 4—calculate fire risk by vegetation or fuelbed type in the Project Area

a) Differentiate fire risk for each fuelbed or vegetation cover type using expert judgment based on published guidelines, or employ an algorithm based on fuelbed structure.
b) There are no published algorithms that assign a Relative Fire Risk by fuel or vegetation type, but we offer the following as an example of several that have been proposed: (this subject deserves much more investigation)

   a. Hypothesis 2, h2:
      $RFR_i = {}^{1}/_{RFRI_i}$
      $RFRI_i = 2.0 + 2.3C_{surface.i}$

      RFR_i = Relative fire risk for fuelbed i
      (Probability of burning per year, 1/yr)
      $RFRI_i$ =Relative Fire Return Interval (frequency of expected fire, yr)
      $C_{surface\ fuel}$ = Carbon store (fuel load/2) in surface fuel strata (ton/A)
      i = FCCS fuelbed identifier (Ottmar, 2007) or substitute classification.

c) Establish a table of regional-area adjusted fire risk (fire return interval or expected percent annual area burned) such that the product of fire risk multiplied by proportion of area covered for each fuelbed type in the Large Area equals the wildfire burned-area baseline.

Adjusted Fuelbed Annual Fire Risk, $AFR_i = Adj \times RFR_i$,

$$where: Adj = TimeHFR_{ref} \div \sum_{i=1}^{numberoffuelbeds} (RFR_i \times Area_{i.ref})$$

Step 5—Calculate carbon flux (C released per area burned) for each fuelbed or vegetation type.

a) Utilize a recognized fuel consumption model such as CONSUME, FOFEM, FEPS, or FCCS at the moisture scenario appropriate for wildfire to compute carbon flux for each FCCS Fuelbed or type.

$$CFlux_{i.wildfire} = f\,(fuel.moisture.scenario)_{wildfire}$$

Step 6—Calculate baseline carbon flux (C released per year) for Project Area

a) Multiply carbon flux by adjusted area burned for each Fuelbed, then sum.

$$\text{Project Baseline Carbon Flux} = BCFlux_{project.wildfire} = \sum_{i=1}^{number.of.fuelbeds} (AFR_i \times CFlux_{i.wildfire})$$

III. TRIAL APPLICATION DRAFT PROTOCOL for establishing GHG emission project baselines for SHASTA COUNTY, California

Step 1—Establish a Large-Area Baseline:

Despite extreme variability, there is little choice but to rely on the historical record as starting point for establishing a GCG emissions from wildfires. In order to obtain a reasonable sample of annual burned area one must choose a large enough area and long enough record to be reliable, in most cases larger (and more diverse) than the project area. There are several sources of historical fire records covering large areas. All are secondary compilations of individual fire reports from public agencies. The fire reports have their own accuracy problems, but are the only source currently available. Remote sensing by satellite is slowly replacing individual fire reports as a source of area-burned monitoring, but remains unreliable other than for very large fires.

We explored several possible large area baselines based on Statewide (California and Oregon) fire occurrence records as well as a number of vegetation or fuel classification systems. Few states have as complete or accurate records of wildfires as California. California also shares with Washington and Oregon the best record keeping systems for prescribed fires. In addition to statewide records, there are data bases established to assess fires by ecoregion and land cover types (figure 2).

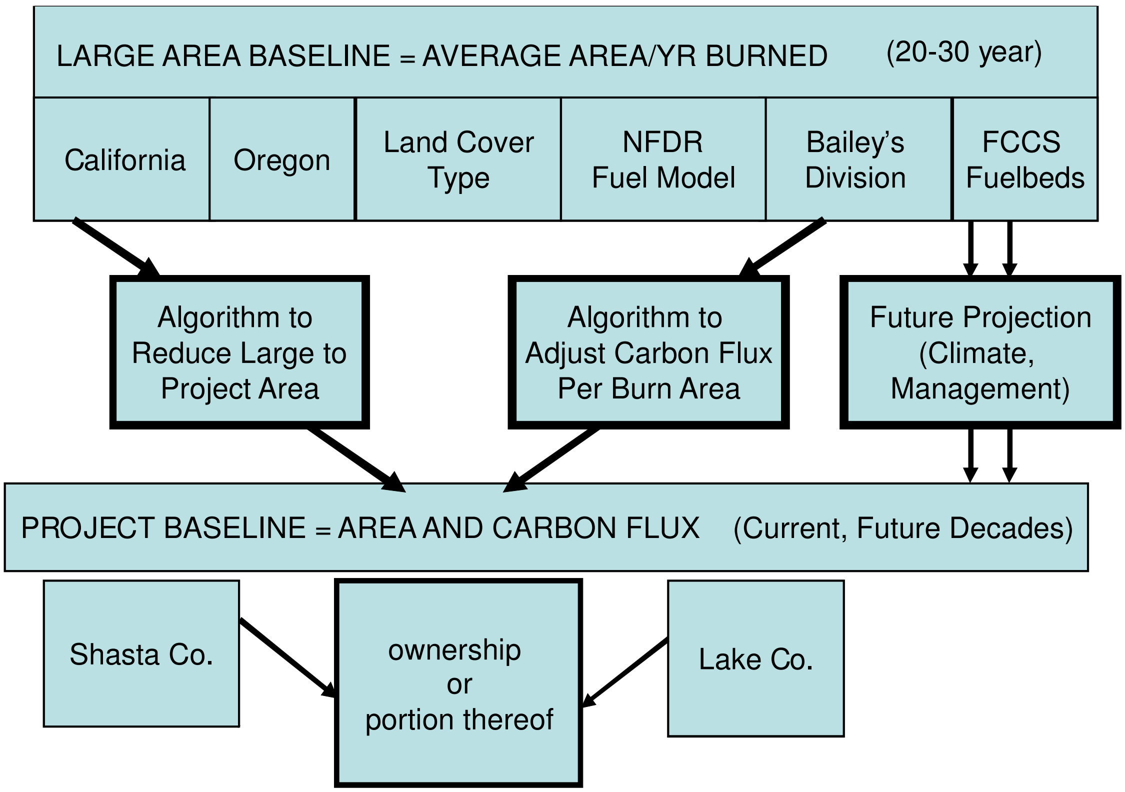
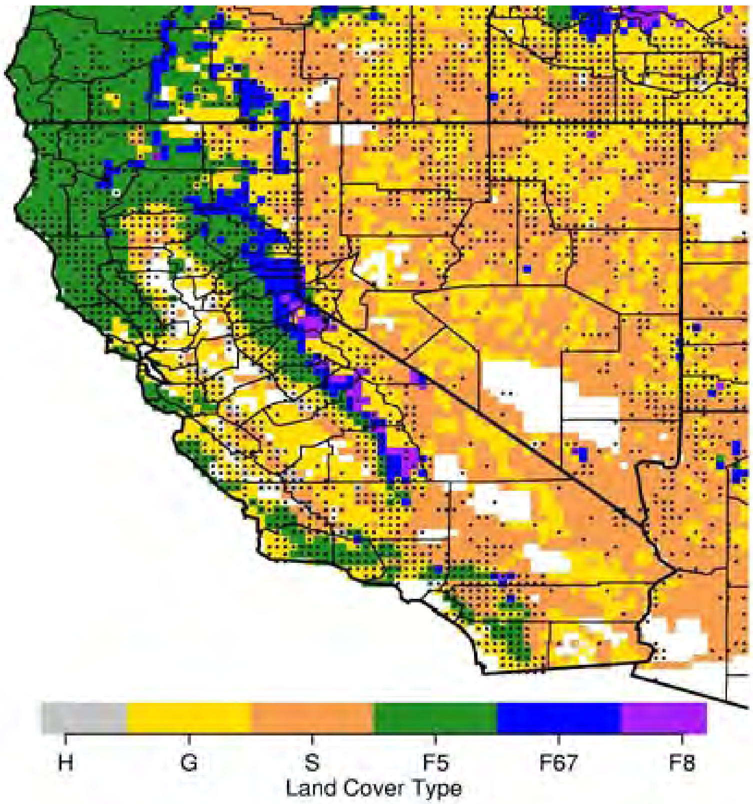
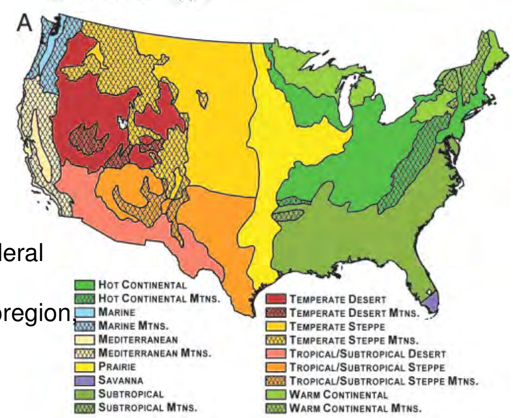


Figure 2. Adjusting large area baseline to project area

Several assessments have been made of the historical fire record in California and in eco-regions that include California and Southern Oregon by the California Climate Center (Westerling and Bryant 2006) , the Desert Research Institute (Brown 2002, Malamud et al 2006) and CFRAP (CDF 2003, Brown et al 2006). Malamud and others (ibid) examined 30 years of federal fire data to establish an expected area burned by Bailey's eco-region (figure 3).

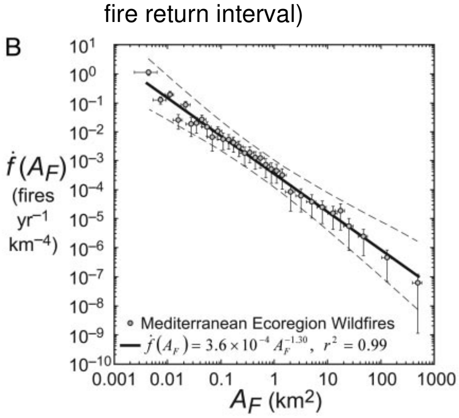
Westerling, Bryant 2006





DRI-CEFA (Brown 2002; 30 year federal data)

Malamud et al 2005; (Bailey's ecoregion fire return interval)



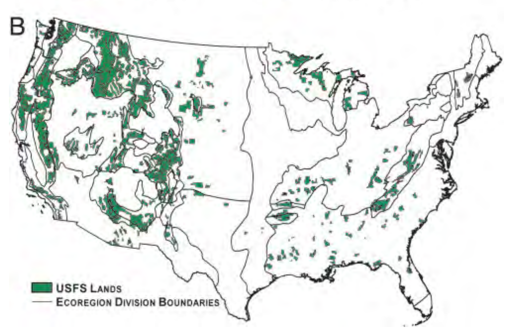


Figure 3. Fire return interval established for Bailey's eco-regions using 30 years of federal fire reports.

Establishing a baseline for wildfire activity has a very weak anchor point in the historical record. It is difficult enough to establish an average or a trend for wildfire area burned annually (or even buy decade) on a national Scale, but almost impossible on any smaller scale. The states of California, Alaska, Montana, Oregon, and Colorado have each recently dominated the area burned in one calendar year; and each have exceeded their previous record for area burned within the past decade. About the most that can be said is that: over the past 20 years in the State of California, or in the mountainous western United States, about 0.3-0.7 percent per year has burned over in an average year, as in figure 4. The two eco-regions that best represent the Sierra Nevada and Southern Oregon project area have experiences .34 and .52 percent per year burned area.

	1	2	1	2
	Area (ac)	Area (ac)	Percent	Percent
Year	Public	Private	Public	Private
1985	1,863	367	0.070	0.019
1986	129	393	0.005	0.021
1987	83,344	4,272	3.116	0.224
1988	1,976	4,881	0.074	0.256
1989	400	379	0.015	0.020
1990	4,505	15,175	0.168	0.795
1991	314	818	0.012	0.043
1992	5,132	41,741	0.192	2.188
1993	81	1,013	0.003	0.053
1994	5,241	1,001	0.196	0.052
1995	103	0	0.004	0.000
1996	7,342	392	0.275	0.021
1997	79	39	0.003	0.002
1998	3,836	1,020	0.143	0.053
1999	13,670	5,547	0.511	0.291
2000	20,959	4,757	0.784	0.249
2001	16,906	4,345	0.632	0.228
2002	19,895	2,272	0.744	0.119
2003	1,988	3,016	0.074	0.158
2004	2,809	1,799	0.105	0.094
Total 20 years	190,573	93,228		
Total 10 years	87,588	23,188		

%AreaBurned/yr

(CFRAP, Brown et al)

	Annual percentage Public	Private
1985-1994	0.385	0.367
1986-1995	0.378	0.365
1987-1996	0.405	0.365
1988-1997	0.094	0.343
1989-1998	0.101	0.323
1990-1999	0.151	0.350
1991-2000	0.212	0.295
1992-2001	0.274	0.314
1993-2002	0.329	0.107
1994-2003	0.337	0.117
1995-2004	0.328	0.122

Malamud M261	.52
Malamud 260	.34
Cal (WRAP)	.58
Cal (FF+)	.70

Figure 4. Large-Area Baseline wildfire burned area (from Brown et al 2006) compared to California wildfire area burned (CDF) and Malamud (2005) area burned in two ecosystem domains.

The simplest baseline area burned would be to project a future where percent of the project area were expected to burn each year would remain constant (represented by the past 30 years)

$HFRisk_{ref}$ = Historic Annual Area Burned (in Large Reference Area, A/yr)/Large Reference Area (A)

$$HFRI_{MalamudM\,261} = 0.52\% / yr$$

Step 2—Inflate Large-Area Baseline to account for wildfire increases

In addition to being extremely variable year to year, wildfires occurrence does not regress over the decades to a historical average. As the climate warms and fire seasons become longer, the area burned by wildfires in the United States is trending upwards at a rate of a few hundred thousand acres per year.   One estimate, by Neilson and Lenihan (2004) (see figure 1), is that wildfire area burned in the contiguous United States will grow at about 430 thousand acres per year, or an annual inflation rate of 0.7 %/year. Westerling and Bryant (2006) used a completely different analysis to predict similar inflation (0.5 %/yr) based on scenarios from General Circulation Models (figure 5), and Wilkenson (2002) predicts about an 0.9%/yr increase.

CCI: Climate Change Area Inflation (%/yr) = 1.007   ?

Westerling, Bryant 2006

Figure 6. Standardized annual expected number of 1/8 degree x month voxels with at least one large fire (> 200 ha, or > 494 acres) 1951–2100 for A2 and B1 emissions scenarios and GFDL and PCM global climate models. Bold lines are the result of smoothing with Friedman's supersmoother (Friedman 1984) with a span of 0.3.

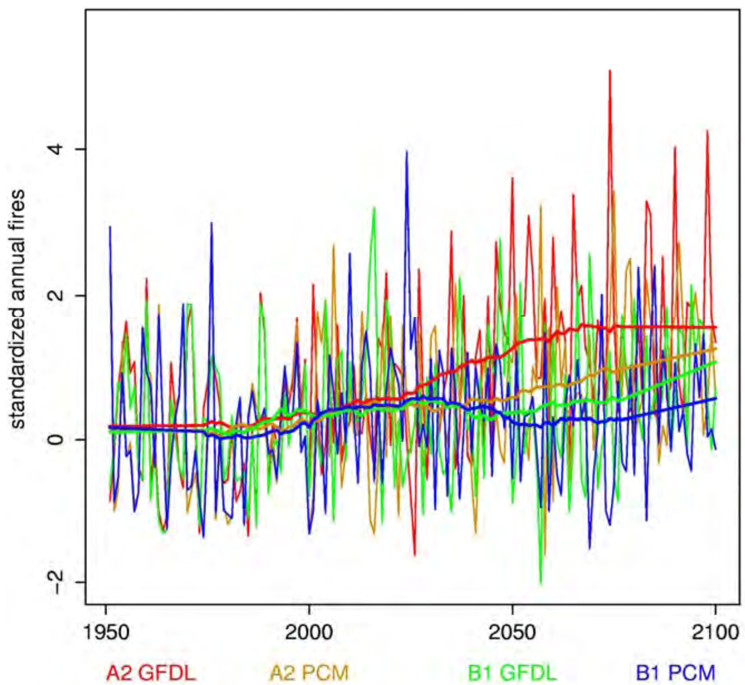


Figure 5. Predicted increase and annual variability in California wildfire burned area by Westerling (2006)

We should consider inflating historic estimates and future baselines by that amount, for example, for 2008 and 2058 baselines:

$TimeHFR_i = HFRI_i \times yrs^{aif}$, *where*

$TimeHFR_i =$ Time-inflated historic fire risk (1/yr)

$yrs =$ years between refernce period and analysis period

aif = annual area-burned inflation factor (default aif = 1.007)

$$TimeHFR_{M\,261.2008} = 0.52 \times 1.007^{20} = .60\%\,/\,yr, and$$

$$TimeHFR_{M\,261.2058} = 0.52 \times 1.007^{70} = .85\%\,/\,yr, and$$

Step 3—Relate Large-Area Baseline to Project Area Vegetation Cover:

a) Using the FCCS mapping capability (McKenzie et al 2007) or other spatial classification of fuelbed or vegetation classification, determine the proportion of area covered by each class in candidate Large (reference) Areas.

b) Using the same classification, determine the proportion of Project Area covered by each class

$$PArea_{i.ref} = Area_{i.ref} \div \sum_{i=1}^{n} Area_{i.ref}$$

$$PArea_{i.project} = Area_{i.project} \div \sum_{i=1}^{n} Area_{i.project}$$

PArea is the proportion of the total area in either the Large Area (ref) or Project Area (project) covered by FCCS Fuelbed i.

Available fuel loading for many vegetation types is uniquely available by accessing the Fuel Characteristic Classification System, or FCCS (Ottmar and others 2007). The system enables land managers and scientists to create and catalogue fuel measurements taken in the field or to choose from a limited library of a few hundred “canned” FCCS fuelbeds selected on the basis of vegetation cover type and Bailey’s eco-region province. Those FCCS fuelbeds have been mapped for the contiguous United States on the basis of remotely-sensed vegetation cover (McKenzie et al 2007; figure 6),

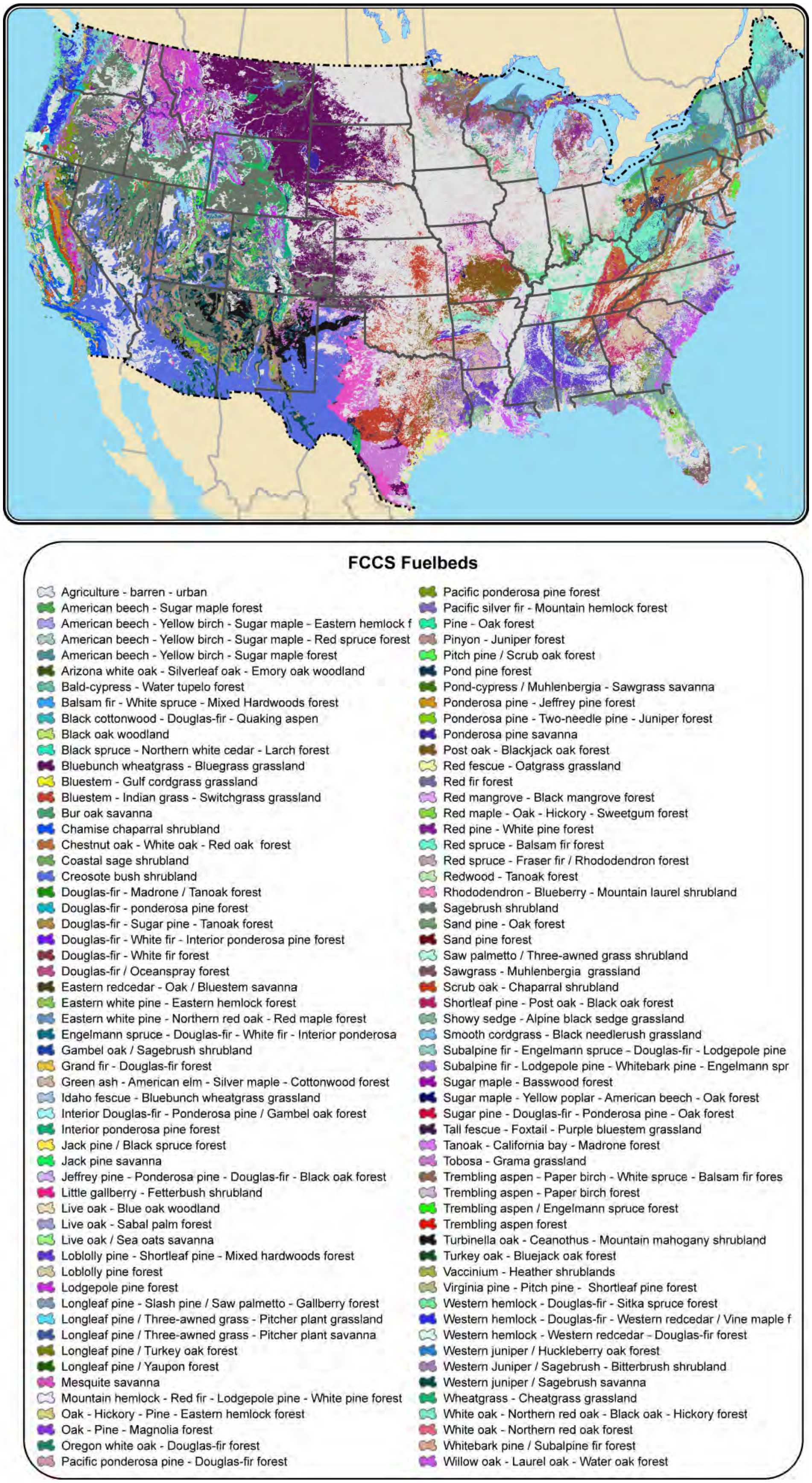


Figure 6. National map of FCCS fuelbeds (McKenzie et al 2007)

and those authors have contributed a breakdown of FCCS fuelbed coverage of the Large Areas (i.e. California, Oregon, and Provinces 260, M261, and 340) and County (Lake Co. OR and Shasta Co. CA) areas considered in this project (figure 7).

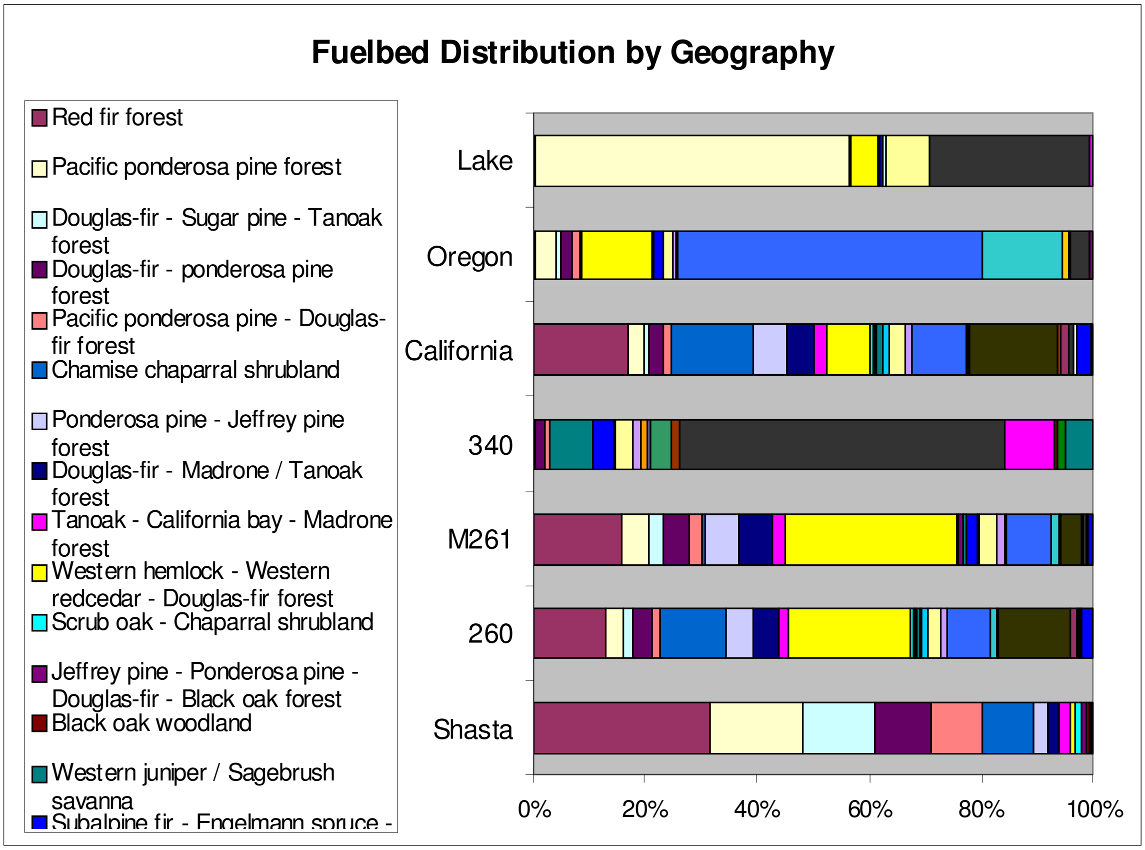


Figure 7 FCCS Fuelbed distribution in Large Area baseline references and in Project Area counties, contributed by McKenzie et. al.

Visual comparison of fuelbed distributions in Shasta or Lake County to any of the Large Area baseline references in figure 6 makes it obvious that some adjustment should be made to the large-area estimates of wildfire area burned and the estimate of biomass available for consumption in a wildfire.

Step 4—calculate fire risk by vegetation or fuelbed type in the Project Area

Adjusting the expected Fire Return Interval (FRI) from the Large Area to the Project area is more problematic. Let me specify up front that there is <u>no</u> published literature that can adjust the FRI based on measured physical attributes of a fuelbed or vegetation structure. While it is clear that fuelbeds such as "wheatgrass" will have a very short FRI relative to "red fir forest", there is no generally accepted algorithm for calculating either on the basis of fuel characteristics. So all we can do now is form hypotheses and see if they look reasonable.

The Project Area will almost differ from the Large Area in two significant ways, unless the distribution of vegetation cover is identical in the two areas because both 1) the Fire return interval (and percentage of area burned per year) and 2) the fuel loading are strong expressions of vegetation cover. In general, the natural fire return interval is very short (on the order of 1-3 years) for grasslands, intermediate (10-50 years) for shrub lands and pine forests, and longer (100+ years) for other coniferous forest lands. The natural fire return interval for many vegetation, not to be confused with return interval for lands under management, is extensively available in the literature.

Conversely, the shorter fire-return interval vegetation types typically have less available fuel loading (i.e. fuel load that would burn in a fire than the longer-interval types. Does that mean, as sometimes assumed, that the two factors offset? That over any long period of time, the product of accumulated available fuel loading and probability of fire each year is constant? No, because ecosystems with a longer fire return interval sequester a greater proportion of carbon in structures that are unavailable for consumption by fire. So, the longer Fire Return Interval ecosystems types can be expected to yield less carbon as a result of fire on an average annual basis.

a) Differentiate fire risk for each fuelbed or vegetation cover type using expert judgment based on published guidelines, or employ an algorithm based on fuelbed structure.
b) There are no published algorithms that assign a Relative Fire Risk by fuel or vegetation type, but we offer the following as an example of several that have been proposed:

    a. Hypothesis 2, h2:

$$RFR_i = {}^{1}/_{RFRI_i}$$
$$RFRI_i = 2.0 + 2.3C_{surface.i}$$

RFR_i = Relative fire risk for fuelbed *i*
(Probability of burning per year, 1/yr)

FRI h2: One hypothesis (h2) is that one can differentiate the likelihood of fire during any time period by measuring the buildup of surface fuels, such that risk is roughly inverse to the fuel loading in the surface (i.e. litter, down woody, herbaceous, and shrub vegetation) fuelbed strata. The FCCS system accounts for biomass allocation (Sandberg and others 2007) in such a way that we can calculate that proportion for each FCCS fuelbed. There are alternative hypotheses, but this one results in an expected FRI ranging from 2 to 108 years, as shown in figure 8. These expected, but not regionally adjusted natural fire return interval are not in conflict with the rage of FRI's reported in the ecological literature. Chamise-chaparral fuelbeds, for example, would have an approximate natural fire return interval of 25 years, while wheatgrass would burn every 2 years.

This is only one hypothesis of many possible hypotheses that relate physical fuelbed characteristics to fire risk or historical fire return interval. It has never been tried before. But it is reasonable that any algorithm based on the allocation of carbon to grasses and other flash fuels increasing fire risk and on the allocation of carbon to coarse fuels and canopy fuels will have some value in explaining the variation in fire return intervals among ecosystems.

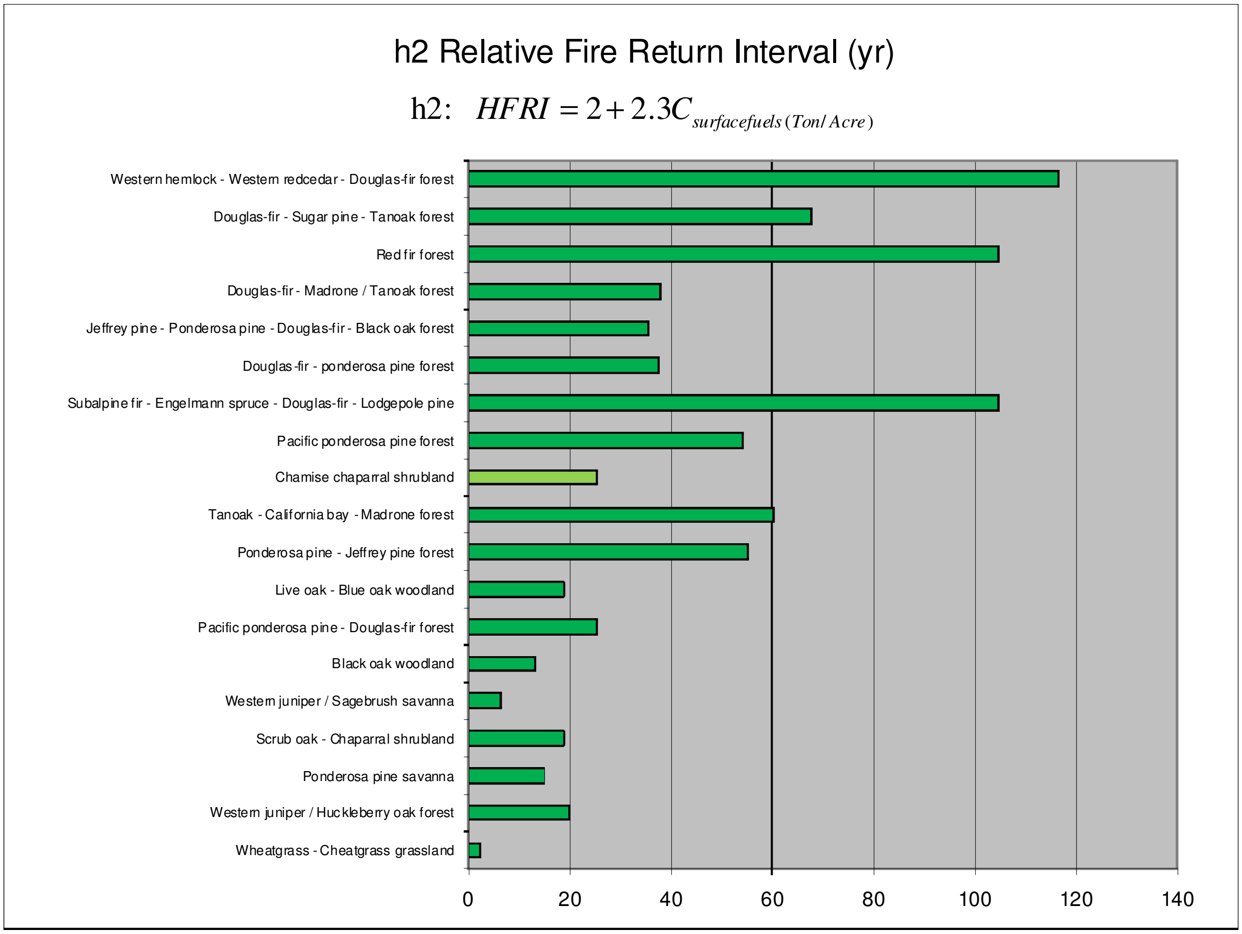


Figure 8. Relative Fire Return Interval (inverse of the annual probability of wildfire on any area) based on the hypothesis that fire return interval is directly proportional to the carbon (C) storage in the surface fuels.

Relative Fire Return Interval, RFRI, is an rough approximation of the natural fire return interval for each Fuelbed. RFRI must be adjusted regionally, by normalization, to the observed historic (or time-inflated) Large Area baseline area burned in order to calculate an expected area burned for the Project Area. At this point, I assume the Project Area will be the entire of Shasta County, although the same procedure would be used for any size project.

As a test, I normalized the relative values by constraining the sum of the products of 1/RFHI x Fuelbed Area for each fuelbed to the observed 30-year average area burned in the Large (reference) Area (figure 9). As validation, I used three Large Area reference areas to test h1 and multiplied the expected (i.e. baseline) area burned by the wildfire carbon flux for each FCCS fuelbed (from figure 8). There is a variance of about 20% among the three estimates which I accept as a reasonable, if not perfect, validation. Perfect validation would result in identical estimates of expected area burned regardless of the Large Area used as reference.

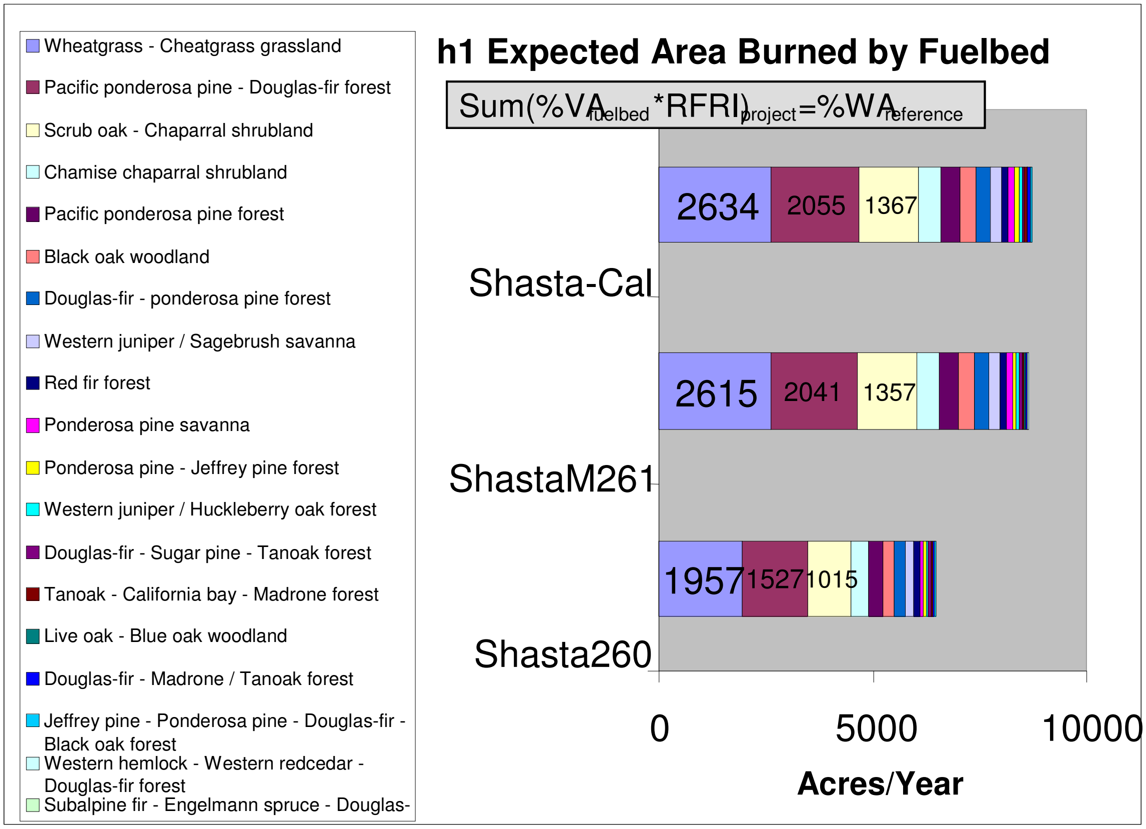


Figure 9. Expected (historic baseline) area burned annually by in Shasta County CA by FCCS, normalized on the basis of Relative Fire Return Interval, to the area burned in California and in two Provinces (M261 and 260) of Bailey's ecoregion classification. Wheatgrass –cheatgrass fuelbeds account for the largest contribution to wildfire baseline burned area.

I accepted Bailey's Province M261 as the most representative Large Area for the Project Area, based on the relative similarity of vegetation cover, and adjusted the h1 Relative Fire Return Interval for each FCCS Fuelbed in that Province (from figure 8) and forced (i.e. normalized) the sum of products to yield the observed historic fire burned area in that province. The calculated fire risk (inverse of fire return interval) for each Fuelbed (figure 10). As expected, the adjusted annual fire risk is greatest for grasslands (3.6%/yr) and lowest for coastal and high elevation coniferous forests (.07-.08% /yr) . Mid-elevation forest lands (where timber management is most often practiced) are estimated to have an average fire risk of 0.07% (Red fir) to 0.29% (Ponderosa pine-Douglas-fir).

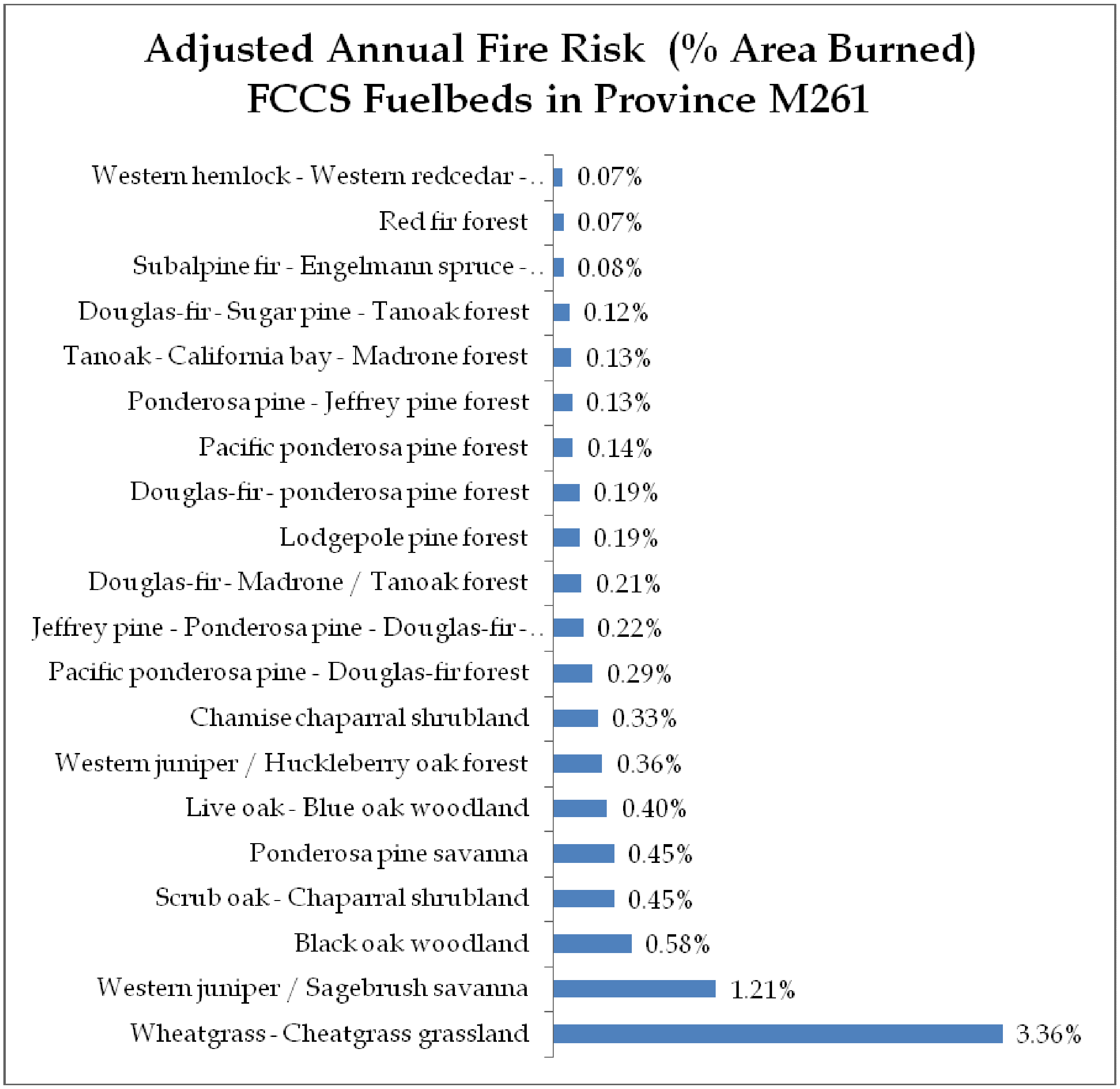


Figure 10 Historic annual fire risk for FCCS fuelbeds in ecosystem province M261. The individual fire risk are assumed to be the same for any Project Area (including Shasta County) in the Province

There are other ways to approach a calculation of baseline area burned. Under a separate subcontract with Winrock, scientists at the University of California, Berkeley (UCB) compiled a detailed fire history in Northern California using a vegetation classification system independent of Bailey's classification and FCCS. The two baseline estimates are illustrated in figure 11. There is no crosswalk currently that allows detailed comparison of the results other than to make a couple of gross observations 1) the UCB estimates an annual area burned in Shasta County to be about 10,000 acres while the h2/FCCS method estimates 8700 acres, and 2) a greater share of the estimate in the h2/FCCS is in grasslands. Shasta County covers 2472470 Acres, so the two methods yield an annual fire risk of 0.041 (UCB) and 0.035 (FCCS).

Comparison of Shasta County Baseline Area burned estimates from UCB (10021) andFCCS(8701) Acres/year. It would be useful, but take a few days of effort, to assign an FCCS fuelbed to each vegetation type in the UCB analysis. The two bars on the Sandberg data reflect baselines derived from the Californiaand M261 ecoregion-wide fire histories.

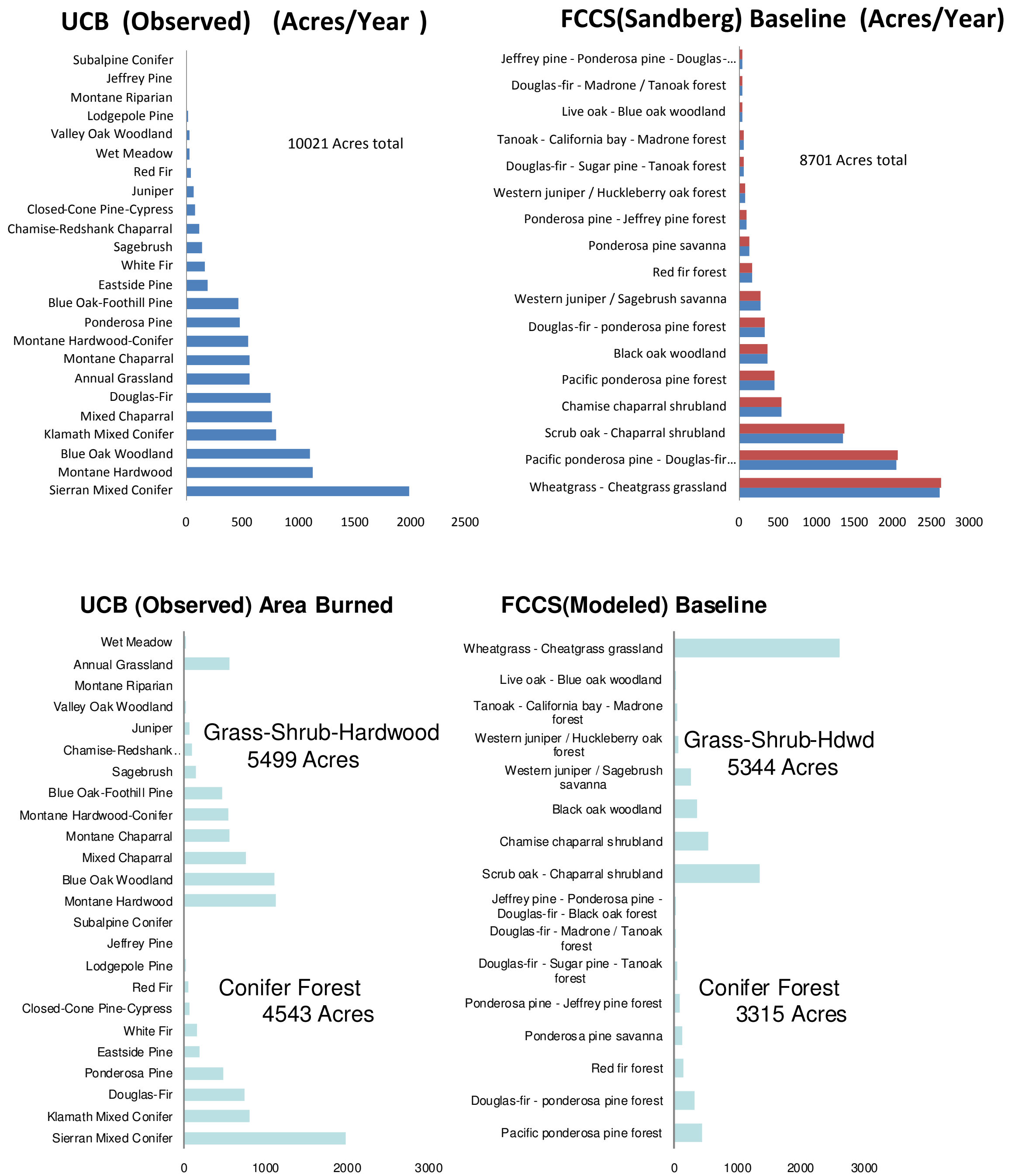


Figure 11 . Comparison of expected (historic baseline) area burned annually by in Shasta County CA using the University of California (observed) and the FCCS (modeled) methods. , Fuelbeds and vegetation classes grouped by life form.

Step 5—Calculate carbon flux (C released per area burned) for each vegetation of fuelbed type.

Each of the FCCS fuelbeds imputed to the geographic areas in figure 6 have a distinct fuel loading. FCCS includes measured values for each size class (0.1-hr, 1-hr, 10-hr, 100-hr, and 1000-hr) and category (foliage, nonwoody vegetation, shrub, woody, litter, and duff) in each fuelbed. Several fuel consumption models, with fuel moisture profiles as inputs, are available to estimate biomass consumption from any FCCS fuelbed or directly measured fuelbed profile. I ran one of these models, i.e. model now integral to FCCS software, to calculate total fuel consumption (expressed at tons/acre carbon flux) at three fuel moisture profiles based on the 1000-hr moisture content (figure 12). The lowest fuel moisture would be representative of wildfire conditions, while the two other moisture scenarios span the typical range of prescribed fires. Several other models are available whose use would be justified, including CONSUME (Ottmar et al 2005), FOFEM (Reinhardt et al 2001), and FEPS (Anderson et al 2004).

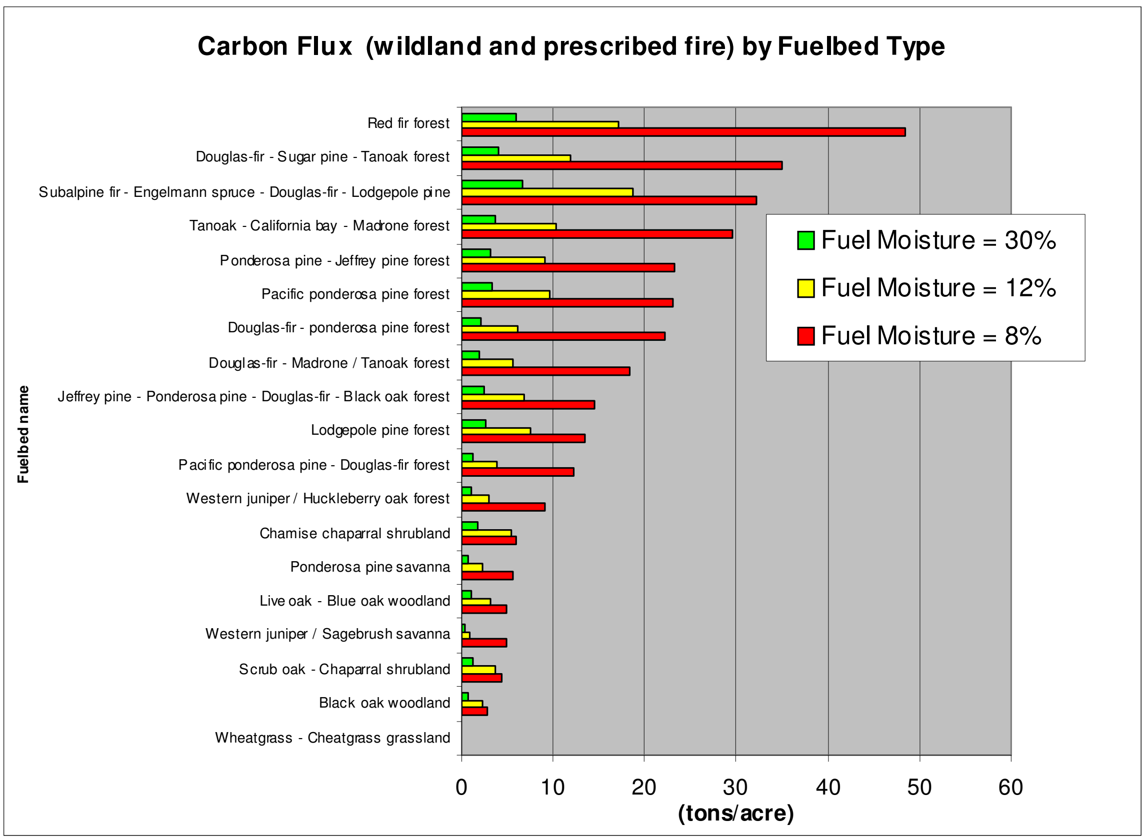


Figure 12. Carbon Flux (tons/acre C) for FCCS fuelbeds in Oregon/California at three 1000-hr moisture content profiles. The "8%" moisture profile represents an average wildfire; 12% and 30% represents a range in fluxes expected from prescribed fire in each fuelbed.

Step 6—Calcualte historic baseline carbon flux (C released per year) for Project Area

a) Multiply carbon flux by adjusted area burned for each Fuelbed, then sum.

$$\text{Project Baseline Carbon Flux} = BCFlux_{project.wildfire} = \sum_{i=1}^{number.of.fuelbeds} (AFR_i \times CFlux_{i.wildfire})$$

Finally, the expected (historic baseline) annual area burned for Shasta—M261 (figure 11) was multiplied by the expected carbon flux from wildfires (figure 12) for each FCCS fuelbed to yield a historic baseline annual carbon flux for Shasta County (figure 13). Although a grass fuelbed (Wheatgrass-cheatgrass) is the greatest contributor of annual expected burned area (2600 acres), the type contributes only 300 tons per year to the carbon flux baseline. There are 11 Conifer-forest FCCS fuelbeds identified in Shasta county that contribute a total of 81000 tons per year to the Carbon flux. Shrub and deciduous forest fuelbeds contribute another 20100 tons per year to a total carbon flux of 104,443 tons C per year.

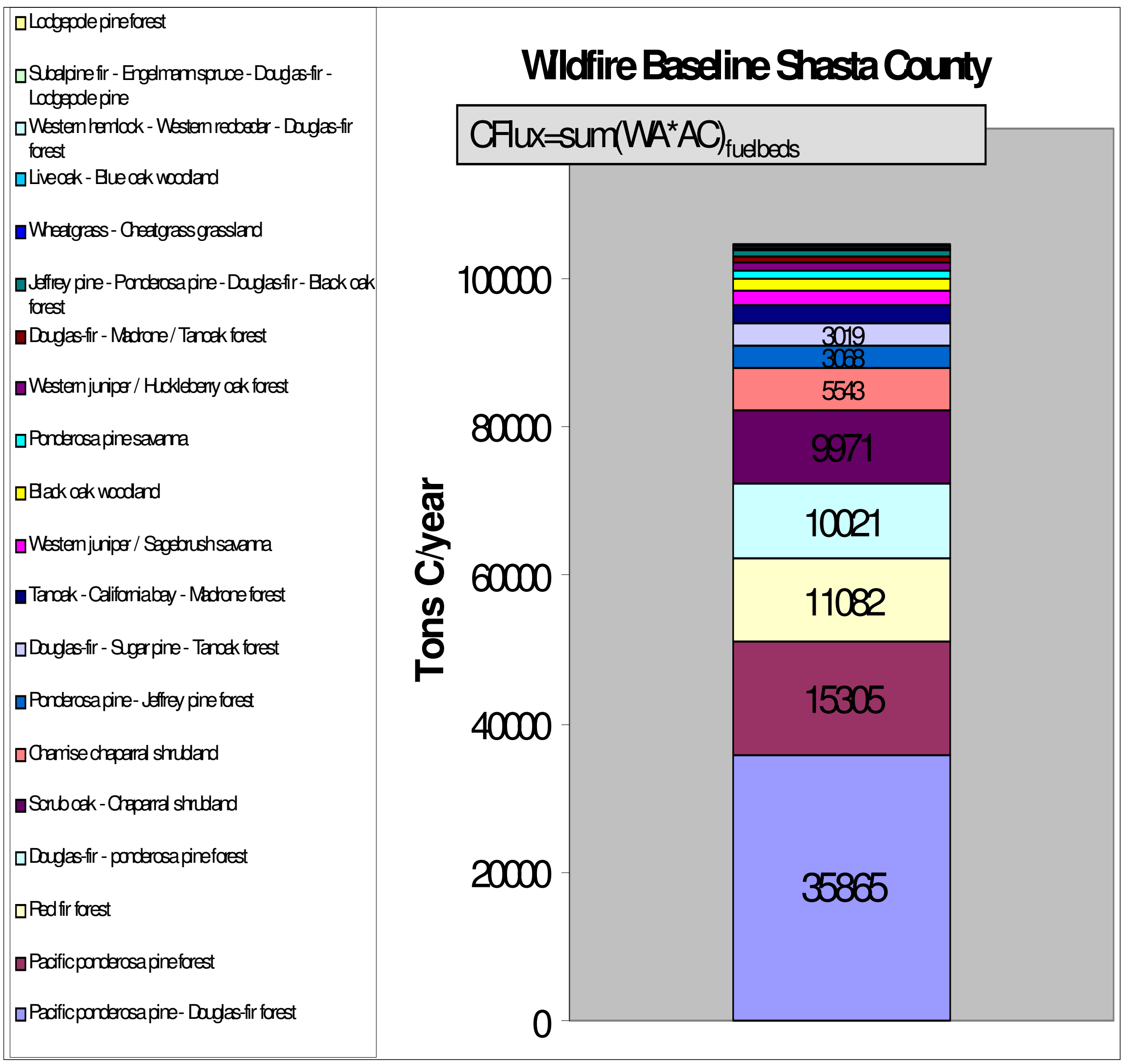


Figure 13. Historic wildfire carbon flux in Shasta County by FCCS Fuelbed type, i.e. the expected annual area burned by the wildfire carbon yield from each fuelbed present in the county. The greatest contribution to the baseline carbon flux are 4 coniferous forest types (Ponderosa pine-Douglas-fir, Ponderosa pine, Red fir, and Douglas-fir-Ponderosa pine). Total historic baseline wildfire carbon flux is 104,443 Tons per year.

Steps 4 and 6 in this test case were based on the Historic Fire Risk rather than a time adjusted risk (Step 2) Returning to the issue of the observed and predicted inflation of annual wildfire area burned, one could apply an factor of 1.007/year to the carbon flux in figure 13. Assuming that no increase in area carbon flux (tons/acre) occurs simultaneously, the 104 thousand tons per year can be expected to have increased to at least 120 thousand tons per year by 2008 and to 170,000 tons by 2058.

IV. SUMMARY and CONCLUSION: Draft protocol for establishing GHG emission project baselines for Wildland Fire Carbon emissions from wildland fire.

- Establishing Project baselines and measuring offsets for fuel management to reduce wildland fire greenhouse gas emissions must rely on modeling. Direct measurement is an unreliable baseline because of the episodic nature and extreme annual variability of fires.
- The baseline for wildfires is not a historic baseline, but is what would have occurred in the absence of fuel treatment in a future also affected by climate change, vegetation land use patterns, and cultural trends.   The annual fire risk in most of the United States is increasing at between 0.5% and 0.9% per year.
- The same methodology and assumptions must be used both for establishing a baseline and for measuring the success of mitigating treatments, because any methodology used is likely to be less accurate than the magnitude of the offsets measured.   The selected methodology must be precise enough to detect change and be repeatable by different analysts at different times.
- The draft protocol described in this report is based on quantitative algorithms that require no subjective or expert input.   However, the assignment of relative risk based on vegetation or fuelbed characteristics is speculative. The example provided is based on an unpublished and narrowly-validated algorithm for that step. This represents a promising avenue for additional research.
- This analysis is intended to be fully transportable and can be used with a minimum of intensive data inputs.   All information used for the baseline calculation exists in the public domain. Results could be improved with some specific site data characterizing the fire environment including better fuels, topographic, weather, and management influences.
- Alternatives to this approach include accomplishing a data-intensive and expert-system driven “fireshed” analysis under trial by several federal land management agencies. It is unknown whether that approach will provide adequate precision or repeatability, but it may prove a better alternative where its expense is justified.

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VI. WORK LEFT UNDONE

Establishing a baseline is an essential but an early step in establishing protocols for measuring offsets for forest fuels management, and the proposed methodology presented here is still imperfect. But the modeling framework used to measure baseline emissions can be extended to predict future baselines as well as the impacts of fuel treatments on wildfire and prescribed fire emissions. Next on the agenda:

1. LIFE-CYCLE FLUX ANALYSIS.: Develop the protocols to represent long term forest life-cycle analysis of carbon fluxes from under natural and alternative management scenarios.

Challenging addition work should be done to fully express baseline emissions from managed forests in order to represent the integral of all natural and anthropogenic sources of GHG emissions and sequestration over a forest life cycle (figure 14)

- 100-year, harvest cycle, or biological rotation baseline scenarios accounting for natural and management processes
    - Decomposition
    - Fuel accretion
    - Risk of non-fire disturbance (insects, windthrow, etc)
    - Succesional Change in forest structure (allocation to trees, shrubs, herbaceous, ground fuels)
    - Intermediate harvest
    - Fuel Treatments
    - Prescribed fire
    - Silvicultural treatments
- Recalculation of fire risk resulting from each process at each time interval

2. FUELBED-BASED FIRE RISK QUANTIFICATION: Improve on Step 4: Correlate annual fire risk to physical fuelbed characteristics.

Published statistical correlation between fuelbed characteristics and fire risk is absolutely essential to provide an automated, objective prediction of the effects of fuelbed changes on fire risk. This project provided a proof of concept that biomass production rates and the relative allocation of carbon by ecosystems into various fuelbed strata is useful for predicting natural fire return intervals and annual fire risk.

3. TREATMENT "SHADOW" EFFECT: Develop a simple, automated method for assigning an area-effect multiple for reduction in fire risk.

Spatial patterns of fuelbeds, including treated and untreated areas can be analyzed analytically or statistically to provide measures of percolation or resistance to fire spread. Fire behavior potentials (Sandberg and others

2007) provide a measure of fire spread and extreme fire behavior based on fuelbed characteristics that could be developed into a simple and automated default for the multiplying "shadow" effect of fuel treatments. The US Forest Service intensive "Fire-Shed" analysis is a data rich and expert-judgment based methodology that can be applied in some specific high value cases with good results, but is too subjective and area-limited to be widely transported.

4. INTEGRATION AND APPLICATION: Fuel Characterization Classification System and Consume; R5 Life-Cycle Analysis and SPLATS, Winrock policy development; California

The Winrock-lead contribution to the West Coast Regional Carbon Sequestration Partnership is a groundbreaking demonstration effort involving several agencies, institutions, and private entities. Many advances have been made in a healthy collaborative environment, but there has been no true coalescence into a clear team effort with clear expected application and outcome. The opportunity presents itself in California to apply specific local projects and Statewide programmatic strategies whose value in carbon offsets are measured by jointly developed and accepted set of protocols.

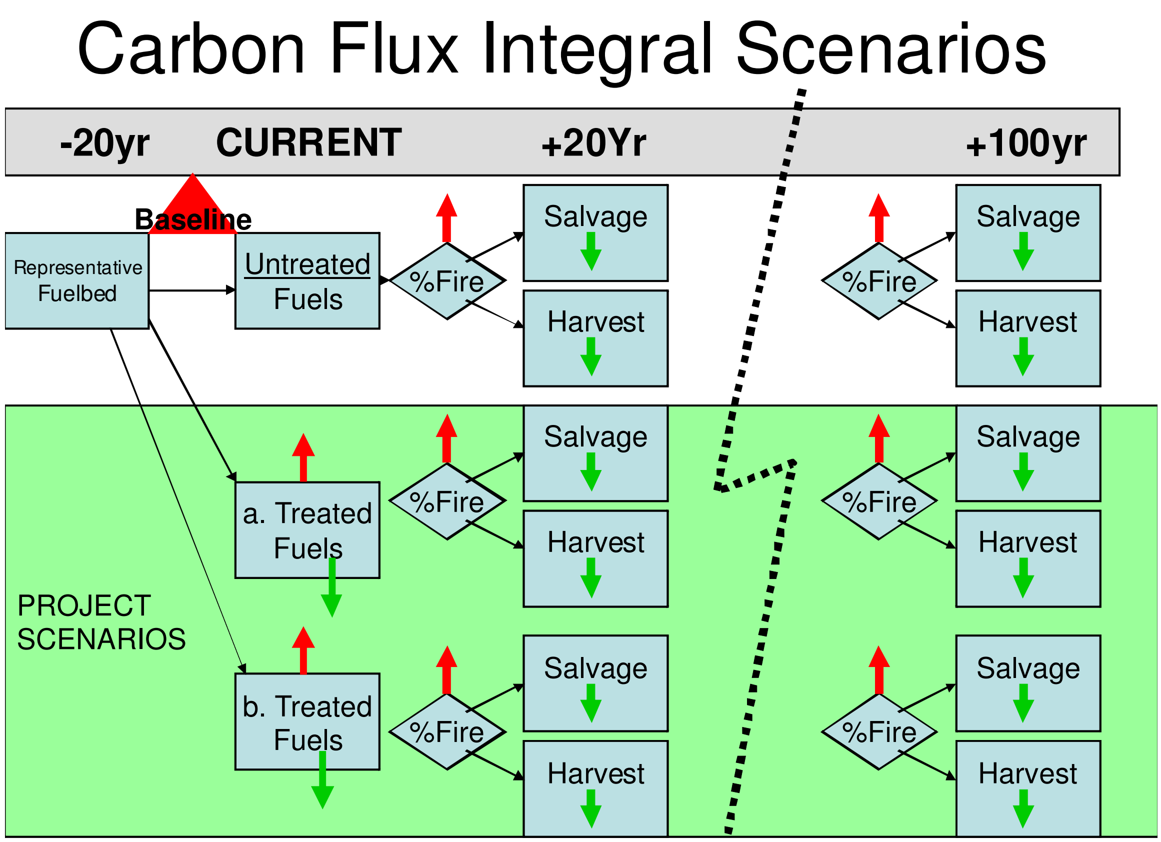

Figure 14. Carbon flux in managed forests consists of several management entries, vegetation succession, and natural events that each have an effect on fire risk as well as emitting or sequestering carbon.

Memorandum of Understanding
Federal ID: 2008 MU11060200-001

Lake County Resources Initiative, Lake County, Town of Lakeview, City of Paisley, Marubeni Sustainable Energy, Inc., The Collins Companies, Oregon Department of Forestry, U.S.D.A. Forest Service Fremont-Winema National Forests; Bureau of Land Management- Lakeview District

I. Authorities

A. This Memorandum of Understanding (MOU) is hereby made and entered into by and among the above listed parties under the authorities noted below.

B. The activities addressed herein may occur under the following principal authorities:

1. <u>Forest Service.</u> Multiple Use Sustained Yield Act of 1960, National Environmental Policy Act of 1969, and the National Forest Management Act of 1976.
2. <u>Bureau of Land Management.</u> Federal Land Policy and Management Act of 1976 and O&C Act of August, 1937. .
3. <u>Oregon Department of Forestry.</u> SB 1072 of 2005

C. The following additional authorities guide implementation of this MOU:

1. Memorandum of Agreement among Department of Energy, Department of Interior and Department of Agriculture of January 21, 2005
2. Lakeview Biomass Energy Facility Oregon Solutions Declaration of Cooperation of January 12, 2006
3. Healthy Forest Restoration Act of 2003
4. 16 U.S.C. 2104 Note (Revised February 28, 2003 to reflect Sec. 323 of H.J. Res. 2 as enrolled)
5. Energy Policy Act of 2005

II. Scope

The scope of this MOU is the lands of the Lakeview, Bly, Silver Lake and Paisley Ranger Districts of Fremont-Winema National Forests, and the Klamath and Lakeview Resource Areas of the Bureau of Land Management.

III. Purpose and Objectives

A. The purpose of this MOU is to provide a framework for planning and implementing forest and rangeland restoration and fuels reduction projects that address identified resource needs while being supportive of the Lakeview Biomass Project.

B. The parties to this MOU intend to work together to achieve the following objectives:

1. Improve and protect
    a. The vitality of forest and range ecosystems and the resiliency of such ecosystems to threats from fire, disease and invasive and noxious species, including maintaining soil productivity and the use of

prescribed fire or vegetation removal to promote healthy forests and rangelands;
    b. Water resources including watershed health and productivity, water quantity and water quality;
    c. Habitat for wildlife and fish;
    d. Air quality, including minimizing air quality impacts by removing excess biomass before the introduction of fire; and
    e. The commercial value of forest biomass for producing electric energy and other beneficial uses
2. Reduce
    a. Hazardous forest fuels on federal lands;
    b. Fire hazards to private lands, at-risk communities, and municipal water supplies; and
    c. Prevalence of noxious and exotic plants and promote reestablishment of native species.
3. Facilitate
    a. The re-introduction of fire in fire-dependant ecosystems by removing unnatural accumulations of fuel prior to re-introducing fire;
    b. A market-based solution for hazardous fuel reduction and biomass removal on federal, private and tribal lands;
    c. Generation of renewable and sustainable energy;
    d. Economic opportunities in an economically depressed area;
    e. The systematic gathering of information to improve forest and range management;
    f. The continued economic vitality of the existing forest products industry infrastructure, including emphasizing the best and highest markets for forest products;
    g. Implementation of sustainable forestry practices and restoration forestry principles on a landscape scale; and
    h. Explore options relative to the potential for stewardship contracting to generate revenue back to counties in lieu of timber receipts or in lieu of the Secure Rural Schools Act as it is phased out.

IV. Mutual Interests and Benefits

A. The federal agencies have identified many acres of forest land that have vegetative stocking in excess of sustainable levels, primarily as a result of successful fire exclusion over several decades and limited silvicultural intervention. Available Congressional appropriations have not been sufficient to rectify this situation. The creation and retention of viable and sustainable markets for this excess biomass would allow additional acres to be treated within anticipated levels of appropriations. Thus, it is to the advantage of the federal agencies to support a viable wood products industry, woody biomass energy generation and other projects that would provide these markets.

B. It is in the interest of the citizens of Lake County to support and foster a positive environment for the wood products industry to continue operation and to expand in Lake County, maintaining and increasing employment, and supporting local governments through taxes.

C. In January 2005, Oregon Governor Kulongoski designated the Lakeview Biomass Project an Oregon Solutions project to help insure its successful implementation. In January 2006, the Governor's project team agreed to a series of objectives in support of long-term economic viability for the biomass project. A key objective is to secure a predictable, economically and ecologically sustainable supply of biomass. Since the primary source of this biomass is federal land, it is to the advantage of the State of Oregon to support efforts of the federal agencies to achieve their goals of healthy forests by helping to create viable markets for the excess biomass on those lands.

V. Commitments

A. The U.S.D.A. Forest Service and the Bureau of Land Management shall:

1. Offer woody biomass for utilization as a component of all applicable contracts or agreements. Such contracts and agreements would contain an optional provision that would allow the contractor to remove woody biomass for utilization where ecologically appropriate. Removal may require payment of a minimum appraised value or payment for services if such removal is required by the government. This option would be contained in any type of contract or agreement the federal agencies utilize for vegetation management projects which are expected to generate woody biomass, unless such biomass was reserved for ecological reasons.
2. Utilize the full variety of contracting methods available under current statutes and authorities. These include competitive integrated resource stewardship contracts, traditional service and timber sale contracts, and sole source agreements.
3. To the extent feasible, offer indefinite duration, indefinite quantity (IDIQ) clauses (for example, consider a 10-year IDIQ contract with annual minimum and maximums accomplished through task orders) in contracts with the expectation that retained receipts will assist in increasing acreage treated.
4. Present a plan showing the different authorities and mechanisms that will be utilized to meet acreage goals, 90 days following signing of this MOU.
5. Meet with parties to this MOU a minimum of once a year and report on progress towards implementing this MOU.
6. Share per-acre yield and utilization data and costs from on-going treatments that are generating sawlog and biomass material to update biomass projections for proposed forest and rangeland treatments.
7. Using the Southern Oregon/Northern California CROP model as background information, update vegetation management project information and scheduling to coordinate planning, implementation and monitoring of projects that generate both timber products and biomass.
8. Consider the purpose and objectives of this MOU during development of all projects that fall within its scope, using adaptive management principles.
9. Strive to assess the best scientific and other credible information available as relevant to the purpose and objectives of this MOU and other considerations used by the agencies in making their decisions on projects within the scope of this MOU.
10. Coordinate and communicate with stakeholders in a timely manner in order to coordinate management activities across political and social boundaries and focus management on proactive activities for ecosystem health.

B. The Fremont-Winema National Forests shall:
   1. To the extent permitted by and consistent with all applicable laws and land use plans, offer a minimum of 3,000 treatment acres per year outside of the Lakeview Federal Stewardship Unit. Treatments on these acres will be designed to support the objectives presented above.
   2. To the extent permitted by and consistent with all applicable laws and land use plans, offer a minimum of 3,000 treatment acres within the Lakeview Federal Stewardship Unit. Treatments on these acres take into consideration the goals and recommendations outlined in the Long-Range Strategy for the Lakeview Federal Stewardship Unit and are consistent with the Chief of the Forest Service's policy for the Unit.
   3. Test ways of reducing the cost of business through utilization of designation by description, sale by weight and conducting environmental analyses on a landscape scale, including contracting out portions of NEPA work.

C. The Lakeview District of the BLM shall:
   1. To the extent permitted by and consistent with funding, all applicable laws, and land use plans, offer a minimum of 2,000 treatment acres per year District-wide. Some of the District acres offered may not be economically feasible for the Lakeview biomass plant to acquire, thus the material utilized by the Lakeview plant may be less than that offered.
   2. Design treatments on these acres which support the Bureau's land treatment objectives.
   3. Offer contracts and/or agreements through a competitive process.
   4. Continue to seek improvement in environmentally friendly juniper removal methods.

D. Lake County Resources Initiative shall:
   1. Work with the Central Oregon Intergovernmental Council (COIC), Mater Engineering, the U.S.D.A. Forest Service, the Bureau of Land Management, and other partners to create a sustainable long-term supply system focused on the Lakeview community (CROP).
   2. Provide local coordination between the Collins Companies, Jeld-Wen and Forest Service on the WESTCARB project with the goal of establishing a carbon credit system for reducing uncharacteristically large fire events to assist with paying for restoration activities.
   3. Work with the Collins Companies and Forest Service to gather field data from the Bull Stewardship Contract to verify economic assumptions utilized in the pro forma for the Lakeview Biomass Project.
   4. Work with the Lakeview Stewardship Group to assure that the long-term Strategy for the Lakeview Federal Stewardship Unit is considered when restoration activities are implemented.
   5. Work with Marubeni Sustainable Energy in any appropriate manner necessary to construct an appropriately sized (estimated to be 10-15 megawatts) facility in Lake County.
   6. Seek out fire plan, implementation grants, biomass and other funding that will assist in meeting the objectives of this MOU.
   7. Help coordinate the pre- and post-treatment monitoring of forest and rangeland treatments.

8. Serve as primary coordinator for monitoring that will focus on (1) economic performance of the CROP initiative; and (2) environmental performance of the projects implemented.

E. Lake County shall:
   1. Use the County's Resource Advisory Committee review process to give priority ranking to Title II County projects that result in forest products utilization.
   2. Work with Lake County Resources Initiative to get the Long-term Strategy for the Lakeview Federal Stewardship Unit working to get supply to the sawmill and biomass plant.
   3. Support both the Fremont Sawmill and Lakeview Biomass Plant at the state and national level.
   4. Support the efforts of the Town of Lakeview, City of Paisley, LCRI and State and Federal Agencies to promote resource management that will result in restoration of healthy forest and rangeland ecosystems and stronger community economies.
   5. Use the Title II process of the Secure Rural Schools and Communities Act to promote projects that support improved forest and rangeland health while strengthening the economies of local communities
   6. Work with all parties to develop and implement a long-term strategy to secure a sustainable supply of forest products and biomass to support the local wood products industry.

F. The Town of Lakeview shall:
   1. Work with all parties to implement strategies which will result in stewardship contracting for the purpose of accomplishing the ecologic, biologic and economic restoration of the forest and rangelands and affected surrounding communities.
   2. Pursue all reasonable political avenues to accomplish the goals and objectives of this MOU.
   3. Work with private businesses to secure the necessary land use and air quality permits to locate facilities in Lakeview.
   4. Work with private businesses to access available state and federal funding sources
   5. Promote this project at all levels as a successful solution to the management needs of the federal agencies and the development needs of the local communities.

G. The City of Paisley shall:
   1. Work with LCRI to identify businesses that can utilize small diameter sawlogs to expand or locate in the Paisley area.
   2. Pursue all reasonable political avenues to accomplish the goals and objectives of this MOU.
   3. Pursue funding to utilize beetle-killed trees for higher market value than chips.

H. Oregon Department of Forestry shall:
   1. Utilize the authority of SB 1072 to help address the beetle outbreak occurring on the Fremont-Winema National Forests.

2. Utilize the authority of SB 1072 to facilitate 10-year stewardship contracts, and other similar contracts and agreements, resulting in a positive partnership with private enterprise and not direct competition.
3. Develop a cooperative state-wide MOU among state agencies and the Forest Service and Bureau of Land Management to combine elements of existing state programs under the following departments: Energy, Economic and Community Development, Fish and Wildlife, and Forestry, to support the work of federal agencies to develop stewardship contracts, and other similar contracts and agreements, to promote bio-energy at competitive prices with market rates for heat and energy.

I. Marubeni Sustainable Energy shall:

1. Execute detailed documents outlining the terms of provisions including Land Lease, Steam Purchase, Water Supply, Sawmill Waste, Chip Sale, and Log Purchase.
2. Arrange for the study of detailed biomass fuel supply, contracting with and providing the majority of funding for Mater Engineering to advance on matters critical to the development of a reliable fuel supply plan for the Lakeview Biomass project.
3. Work with other Oregon Solutions team members to maximize and secure Business Energy Tax Credits, Renewable Energy Credits, Carbon Mitigation Credits, and other applicable local and federal production or investment tax credits to facilitate the development and financing of the Lakeview Biomass project.
4. Lead the advancement of the planning, permitting, design, commercial contracting, financing, construction and long term operation of the Lakeview Biomass project, bringing the majority of the equity capital required to develop and construct the project.
5. Work cooperatively with The Collins Companies on developing supply mechanisms that get sawlogs to Fremont Sawmill and chips from the Lakeview Federal Stewardship Unit at the lowest price possible.
6. Investigate developing a supply merchandizing company that can obtain supply for Forest Service lands both in the Unit and out, as well as supply from BLM lands and private lands.

J. The Collins Companies shall:

1. Work with Marubeni Sustainable Energy on a land lease at their facility, Fremont Sawmill in Lakeview, OR.
2. Work with Marubeni Sustainable Energy on a steam purchase agreement, taking the boiler at the Fremont Sawmill off line.
3. Provide access to an existing well on Fremont Sawmill property for the biomass plant usage.
4. Negotiate the sale of hogfuel from the Fremont Sawmill to the Lakeview Biomass Plant.
5. The Collins Companies will develop a long-term contract to sell chips generated from normal logging operations at a negotiated price to the biomass plant.
6. Should the biomass developer or a subsidiary fuel supply company be developed and long-term contracts obtained by them from the Forest Service

and BLM, the Collins Companies will purchase suitable sawlogs from them at a fair market value.
7. Work cooperatively with Marubeni Sustainable Energy on developing supply mechanisms that get sawlogs and chips from the Lakeview Federal Stewardship Unit at the lowest price possible.
8. Investigate retooling the Fremont Sawmill to process small diameter logs.

VI. Mutual Agreements and Understandings

It is mutually agreed and understood by and among the parties that:

A. Any information furnished to the Forest Service or Bureau of Land Management under this instrument is subject to the Freedom of Information Act (5 U.S.C. 552).
B. Modifications within the scope of the instrument shall be made by mutual consent of the parties, by the issuance of a written modification, signed and dated by all parties, prior to any changes being performed.
C. This instrument in no way restricts the Forest Service, the Bureau of Land Management or the Cooperators from participating in similar activities with other public or private agencies, organizations, and individuals.

D. The principal contacts for this instrument are:

Kevin Moore
USDA Forest Service
Timber Program Manager
2819 Dahlia Street
Klamath Falls, OR 79601
541-883-6735 (Voice)
541-883-6709 (Fax)
jsheehan@fs.fed.us

Mike Bechdolt
Bureau of Land Management
Timber Program Lead
2795 Anderson Ave #25
Klamath Falls, Oregon 97603
541-885-4118

Jim Walls, Executive Director
Lake County Resources Initiative
25 North E Street, Suite 3
Lakeview, OR 97630
541-947-5461 (Voice)
541-947-3268 (Fax)
jwalls@gooselake.com

Brad Winters
Lake County
513 Center Street
Lakeview, OR 97630
541-947-6003 (Voice)

Email: bjwinters@co.lake.or.us

Ray Simms, Town Manager
Town of Lakeview
525 N. First Street
Lakeview, OR 97630
541-947-2029 (Voice)
Email: lakeviewtownmanager
@yahoo.com

Dale Roberts, Mayor
City of Paisley
705 Chewaucan Street
Paisley, OR 97636
541-943-3173. (Voice)
Email: paisleydale@yahoo.com

Joe Misek
Oregon Department of Forestry
2600 State St. Bld D
Salem, Or. 97310
503-945-7414
Email: jmisek@odf.state.or.us

John Wood
Marubeni Sustainable Energy
1660 Union St. #200
San Diego, CA 92101
(619) 232-6564
Email: wood-j@na.marubeni.com

Wade Mosby
The Collins Companies
1618 SW First Avenue, Suite 500
Portland, OR 97201-5708
503-227-1219 (Voice)
503-417-14441 (Fax)
Email: WMOSBY@collinsco.com

E. This instrument is neither a fiscal nor a funds obligation document. Land treatment commitments may be dependent on annual appropriations. Any endeavor or transfer of anything of value involving reimbursement or contribution of funds between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures including those for Government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority. This instrument does not provide such authority. Specifically, this instrument does not establish authority for noncompetitive award to the cooperator of any contract or other agreement. Any contract or agreement for training or other services must fully comply with all applicable requirements for competition.

F. The commitments of the Fremont-Winema National Forests and the Lakeview District, Bureau of Land Management to offer a total annual minimum of 8,000 acres recognizes the intent of all parties to facilitate the purpose and objectives of this MOU to maximize the capability to address hazardous forest fuel treatment needs and forest/rangeland ecosystem, watershed, wildlife and fish restoration needs. Building and maintaining a healthy localized market for biomass material is one critical element to maximizing this capability. All parties further recognize that circumstances beyond the control of all participating groups in this MOU such as delays due to litigation, broad-reaching court decisions, competing markets and demand for biomass in the surrounding area, Congressional appropriations and funding, may impact the timing, scope, amount of acres and methods of implementing the MOU and may require flexible responses to achieve the intent of the MOU on an ongoing basis. All parties also recognize that there is already a demand for forest products, including sawlogs and biomass, from the existing forest products infrastructure presently in place in the western half of Klamath County and surrounding areas which could impact the total availability of forest products deliverable to the new biomass plant.

G. All parties to this MOU recognize that the purpose of the biomass utilization component of this MOU is to create a local and a financially viable use and market for woody biomass material. The parties recognize that, currently, the cost of biomass removal exceeds the market value, if any, for such material and that the mutual success of developing an economically viable market for such material will depend on a long-term supply, reliable markets, and mutual financial feasibility for removing and utilizing the material. In building this market, the parties will use a fair and transparent process for assigning value to woody biomass material.

H. All parties to this MOU understand that the project development processes of the federal agencies are open to everyone and that the federal agencies have neither established nor do they manage or control the operations of any group that may participate in these processes. The ongoing collaboration efforts of the Lakeview Stewardship Group, Lake County Resources Initiative and Oregon Solutions Team will inform federal decision makers on any topic related to the scope of this MOU in any manner deemed appropriate by these organizations. Recommendations from these collaborative planning efforts shall not abrogate or limit the approval authority of USFS or BLM as relevant to their management responsibilities and requirements to comply with federal law including their respective Resource Management Plans or to the terms of this MOU.

I. The Parties expect that individuals and groups participating in project planning collaborative efforts will assist by providing recommendations regarding the development of phased implementation, project identification and development of project protocols. Participating stakeholders will define their own participation in such planning efforts, but it is expected that the Parties will desire and request consultation for the following:

   1. Development of MOU implementation phased plans and schedule;
   2. Development of project plans and protocols;
   3. Identification of project implementation agreements/contracts; and
   4. Development of annual reports related to MOU and project implementation.

J. The Parties expect that stakeholders participating in environmental monitoring collaborative planning will assist in the development of environmental monitoring protocols, implementation and reporting. Participating stakeholders will define their own participation in such planning efforts, but it is expected that the Parties will desire and request consultation for the following:

   1. Preparation of annual reports related to monitoring;
   2. Preparation of project-specific monitoring reports;
   3. Preparation of project-level monitoring plans and protocols; and
   4. Implementation of the monitoring plans.

K. The Parties expect that recommendations from collaborative planning efforts will be primarily based on solid scientific and credible information and post treatment monitoring results.

L. This MOU will be implemented through projects completed in phases in conjunction with federal and CROP resource planning efforts. Phased projects plans will be developed through a collaborative planning process described above. While individual projects including monitoring efforts may be identified and entered into under this MOU, it is anticipated that individual projects and monitoring efforts will be planned and grouped in distinct phases to facilitate coordinated longer-term management. It is anticipated that a typical phased projects plan will cover multiple years, from 3 to 10 years. However phased projects plans may be longer or shorter as appropriate to planning objectives. While it is anticipated that phases will be consecutively implemented, phases may be planned for consecutive, overlapping or concurrent implementation.

M. Phased projects plans will be implemented through a variety of contracting and agreement vehicles, including but not limited to, the vehicles authorized under the Healthy Forests Restoration Act, Stewardship End-Result contracting authority, traditional service or timber sale contract authorities, and cooperative agreements. Phased projects plans will be awarded on an open-competitive basis, on a best-value (stewardship) basis, or on a sole-sourced basis to an appropriate entity, depending on the specific circumstances and authority used. Where STATE OF OREGON and/or a sole-source entity administers a phased projects plan, unless specifically provided otherwise, STATE OF OREGON and/or a sole-source entity may use a variety of tools for implementation, including subcontracts as consistent with federal law. It is recognized that most contract holders intend to merchandise and sell merchantable saw log volumes other than incidental volumes associated with forest fuels treatment and restoration to the highest and best markets as most appropriate for the circumstances of the project and in the best interests of the contract holder.

N. As noted above, project planning and monitoring efforts shall be conducted through a collaborative planning process, described above. This process will be primarily implemented and administered through the LAKEVIEW Stewardship Group process. Lake County Resources Initiative shall take the lead to ensure that collaborative efforts are initiated with interested stakeholders at desired consultation points.

O. All parties agreed to meet at least every five years and preferably every year to review this MOU and progress towards the purpose and goals of this MOU.

P. This instrument is executed as of the date of last signature and is effective for a twenty-year term through **November 1, 2027** at which time it will expire unless extended.

Q. Any of the parties may terminate, in writing, this instrument in whole, or in part, at any time before the date of expiration.

AUTHORIZED REPRESENTATIVES. By signature below, the cooperators certify that the individuals listed in this document as representatives of the cooperator are authorized to act in their respective areas for matters related to this agreement.
THE PARTIES HERETO have executed this instrument.

__________________________	__________________________
Karen Shimamoto	Shirley Gammon
Forest Supervisor	District Manager
Fremont-Winema National Forest	Lakeview District

Chuck Graham
Co-Chair
Lake County Resources Initiative

Brad Winters
County Commissioner
Lake County

Marvin Brown
State Forester
Oregon Department of Forestry

Rick Watson
Mayor
Town of Lakeview

Dale Roberts
Mayor
City of Paisley

Wade Mosby
Senior Vice President
The Collins Companies
Portland, OR

John Wood
Secretary
Marubeni Sustainable Energy

The authority and format of this instrument has been reviewed and approved for signature.

Midori C Raymore
FS Grants & Agreements Specialist

Date

APPENDIX D:
Governor Kulongoski Announces New Biomass Plant in Lakeview

Annex D

Press Release

January 10, 2007

Governor Kulongoski Announces New Biomass Plant in Lakeview

Plant marks first new biomass facility in Oregon in more than ten years

Salem — Today Governor Ted Kulongoski announced that DG Energy will build a biomass power plant in Lakeview, Oregon — marking the first new biomass facility in Oregon since 1992.

"Using biomass from overstocked forests, this innovative project will produce electricity while helping restore forest health, reduce fire risks, and create jobs," said Governor Kulongoski. "This project serves as a model for collaboration between industry, conservationists and state government in enhancing forest health, developing renewable energy and creating jobs."

DG Energy will invest $20 million in the facility and it will produce nearly 100,000 MWHr of renewable energy to the regional Oregon grid annually. In addition, the facility will supply steam to the Fremont Sawmill, owned by the Collins Companies of Portland Oregon. Permits for the plant will be filed in mid-Spring and the facility is expected to be operational in 2008.

The Lakeview Biomass Project was designated an Oregon Solutions project by Governor Kulongoski in 2005. The Oregon Solutions Process resulted in a collaboration of nearly 70 public, private and community organizations to develop an economically viable, ecologically sustainable power plant. The fuel sources for the plant will become a key part of an integrated solution to a multi-faceted forest health problem.

Key partners include: Oregon State University, Portland State University, The Collins Companies, Oregon Economic and Community Development Department, Oregon Department of Forestry, United States Forest Service, Friends of the Winema/Fremont, Bureau of Land Management, Oregon Department of Fish and Wildlife, The Wilderness Society, Oregon Natural Resource Council and Defenders of Wildlife. The Lake County Resources Initiative is the project sponsor.

"We appreciate the support of the Governor and are pleased to have the opportunity to work with the community in the development of this innovative project," said Steve Mueller, President of DG Energy.

The plant will create local jobs in harvesting and hauling the once-unwanted biomass. The salvaged materials that are suitable for solid wood products will be milled, another boon to job development. Additional project benefits will include enhanced water resources, fish and wildlife habitat and renewable energy from a resource that was once a threat to forest health and potentially reduced costs in fire fighting.

"The whole community is pleased that DG Energy is going to build the biomass plant in Lakeview. It will mean approximately 15 jobs at the plant and another 70 in the woods and that is considerable for a community of 2600. Just as important, the biomass plant along with Fremont Sawmill provide the necessary infrastructure to restore the local forests and rangelands back to natural conditions, something many other communities in the West have totally lost," said Jim Walls, Director, Lake County Resources Initiative.

For more details on the project please contact Melissa Moehrke with DG Energy LLC at: 619-232-6564.

Contact:

Anna Richter Taylor: 503-378-6169
Kristina Edmunson: 503-378-5040

APPENDIX E:
Lakeview Biomass Energy Facility: an Oregon Solutions Project

Lakeview Biomass Energy Facility: An Oregon Solutions Project

January 12, 2006

Declaration of Cooperation

1. Project Description and Background

The Lakeview Biomass Oregon Solutions Project is a community-based, multi-stakeholder effort to create an ecologically sound solution to forest restoration that includes an economically viable biomass energy facility.

The biomass energy facility (approximately 10-15 megawatts in size) would be adjacent to the Fremont Sawmill in Lakeview, Oregon. The sawmill is located in the center of the 492,642 acre Lakeview Stewardship Unit on the Fremont –Winema National Forest.

DG Energy is working with The Collins Companies, the owner of the Fremont Sawmill, to pursue the development of the biomass facility, and Collins and DG Energy have entered into initial development agreements and are progressing accordingly. DG Energy has participated in and contributed to the Oregon Solutions Project Team since its inception, and is supported by the Oregon Solutions Team in development of the project as long as DG Energy continues commercially reasonable pursuit of the success of the project as further addressed in this document.

2. Problems Addressed by the Biomass Energy Facility

The Lakeview biomass energy facility would have significant positive impacts on several pressing problems including:

- Improving resilience in forest and range lands
- Reducing CO_2 emissions into the atmosphere
- Creating a source of clean, sustainable energy
- Reducing the risk and cost of wildfire in and around human communities
- Revitalizing a struggling local economy

More than 90 million acres of western dry forests are at moderate to high risk of severe drought stress, insect and disease epidemics and uncharacteristically severe fires due to excessive levels of small diameter biomass from forest floor to canopy. In addition, thousands of acres of rangeland are being degraded by encroachment of western juniper due to fire suppression. The absence of utilization options for small diameter trees and western juniper makes its removal prohibitively costly, and therefore, this material is usually left on the site where it perpetuates unhealthy forest conditions. The biomass energy facility would provide a utilization option for small diameter trees and western juniper. Removing excessive fuel loads would improve forest and rangeland health.

Currently, the piled material is often disposed of in the forest in open burns that degrade air quality and release significant amounts of carbon into the atmosphere. The biomass energy facility would channel that carbon into long-term storage as wood products or offset it by reducing the need for fossil fuel energy sources and their associated carbon emissions.

The facility would generate clean, sustainable energy that would be sold to a utility, and would provide an important model for biomass energy development across the state. Biomass energy is likely to be a significant component of our transition from a fossil fuel based to a sustainable energy system. With dwindling oil reserves, increasing instability in global energy markets, and energy costs that are likely to continue to rise into the foreseeable future, there has never been a better time to develop effective, sustainable community energy projects.

The biomass energy facility would have a direct positive impact on local economic and community development. In Lake County, the local forest sector industry is dwindling. The biomass energy facility would revitalize the economy by creating jobs suited to the skills of forest sector workers. Furthermore, by providing a cost effective way to remove wildfire fuels, it would reduce the currently escalating risks and costs associated with severe wildfire in a region experiencing increasing urbanization and residential development near forested areas.

The Lakeview Biomass Energy Facility is a different resource management model than the model that contributed to the conditions that now place these forests and rangelands and, in urbanizing areas, human lives and property at risk. It entails creation and application of new governance models, new resource management techniques and tools, new processes for utilizing what have historically been unmerchantable forest and range products, and new methods to contain costs and account for the full array of benefits derived from forest restoration. This model will be of value to other western communities facing large magnitude forest health challenges.

3. Oregon Solutions Collaboration

Project success will depend on overcoming several economic and policy challenges through the collaborative efforts of a diverse group of stakeholders. To facilitate this collaboration, in January 2005, Governor Theodore Kulongoski designated the Lakeview Biomass Project an Oregon Solutions project, and appointed OSU College of Forestry Dean Hal Salwasser and Lakeview County Commissioner JR Stewart to serve as project co-conveners. The mission of Oregon Solutions is to develop sustainable solutions to community-based problems that support economic, environmental, and community objectives and that are built through the collaborative efforts of businesses, governments, and non-profit organizations.

The Oregon Solutions designation will help ensure successful implementation of the Lakeview Biomass Project. The Governor has assured participation of his staff and appropriate state agencies with other partners through the designation of this effort as an Oregon Solutions project. It is expected that the creation of an Oregon Solutions Team for this initiative will help make efficient use of available resources, accelerate the pace of the project, overcome potential impediments early on, raise awareness of the initiative on a statewide level and bring effective partners to the table. In this fashion, the Team will commit resources and time to develop and implement an integrated action plan focused on achieving a predictable and stable supply of small diameter material to enable investments in related timber-utilizing technologies and businesses.

To this end, a Lakeview Biomass Project Team was created, composed of individuals, agencies and organizations with a "stake" in ecosystem restoration, renewable energy production, and employment/job creation in Lakeview. Team members and contact information is presented in Appendix B. The team developed a set of ground rules, presented in Appendix A, which assisted them in developing an integrated and inclusive solution. During the course of four meetings, from May through November 2005, the CROP Team agreed on a series of Project Purpose and Goal Statements, and an Implementation plan. These documents were used to build sections 1, 2, 4, and 5 of this Declaration of Cooperation. Section 6 outlines the commitments and contributions to project success of project participants.

4. Goals and Objectives

Goals of the Lakeview Biomass Energy Facility Project include:

- ✓ Development of a biomass-based, renewable energy resource;
- ✓ Recovery of watershed health, including enhanced water flows and quality, improved fish and wildlife habitats, and resiliency to drought, insects, fire and invasive species;
- ✓ Return of natural ecosystem processes including restoring fire's natural role in forest and rangeland ecosystems;
- ✓ Reduced threats to forest and rangeland values, property, and human lives from uncharacteristically severe fire;
- ✓ Reduced future costs of fire suppression;
- ✓ Improved understanding of the role of forest and rangelands, forest and rangeland products and biomass energy as mitigation for carbon dioxide emissions;
- ✓ Creation of forest-based jobs and wealth for long-term residents of rural communities;
- ✓ Enhanced and improved economic resiliency and viability of the regional lumber mill and surrounding communities;
- ✓ Improved efficiency and efficacy of state and federal agencies to carry out their missions (e.g. ecosystem restoration, community economic development, renewable energy development, etc.);
- ✓ Enhanced social capacity to solve problems in ways that build and sustain desired environmental, economic and community conditions.

The product of the Lakeview Biomass Oregon Solutions process will be an Oregon Solutions Declaration of Cooperation signed by all of the partners including state and federal agencies, local government, businesses and non-profits. The Declaration of Cooperation includes an implementation plan for achieving the following objectives necessary to meeting project goals:

- ✓ Secure a predictable, economically and ecologically sustainable supply of biomass;
- ✓ Agree on expedited permitting processes, if appropriate, to avoid project delays
- ✓ Support increased valuation of biomass within energy incentives; maximize utilization of existing financial incentives;
- ✓ Designation of the Lakeview biomass project as a pilot project under various initiatives;
- ✓ Engage in a transparent process that encourages active public/community participation;

- ✓ Ensure a viable energy project by addressing key issues including: power purchase agreement, thermal demand, secondary products, and cost-effective interconnection;
- ✓ Create conditions necessary to make this an attractive investment to secure construction and operation for at least twenty years;
- ✓ Support the development and utilization of ecologically-friendly extraction techniques;
- ✓ Create a replicable template for similar future projects;
- ✓ Integrate into implementation of the Governor's Renewable Energy Action Plan goals.

During early discussions, the Project Team realized that the proposed biomass power facility may not be economically viable in the absence of "intermediate" small diameter tree utilization infrastructure[1] (the Fremont Sawmill cannot currently profitably process small diameter logs), due to the relatively high cost of transporting small diameter biomass from the forest to a site, and the relatively low prices that a biomass power facility can pay for this material. Therefore, the development of intermediate small diameter processing infrastructure is considered critical to the success of the Lakeview Biomass Project, and has been added to the list of project objectives:

- ✓ Identify partners and investors to develop "intermediate" small diameter processing capacity, to derive maximum value and to assist in paying for the transport of biomass material from the woods to the biomass power site.

The graphic model in Appendix D illustrates the interconnection of many of these objectives.

5. Project Implementation Plan

The implementation plan addresses all of the key considerations for project success, and includes the following sections:

I. Stakeholder Collaboration and Community Engagement
II. Supply, Scale, and Design
III. Associated Economic Opportunities
IV. Power Purchase Agreement and Interconnection
V. Credits and Incentives
VI. Permitting
VII. Implementation Team

The full Implementation Plan is presented in Appendix E.

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[1] "Intermediate" SDT infrastructure would be able to profitably process approximately 4-12" DBH trees, such as a post and pole processor or a dedicated small diameter timber primary breakdown line at the Fremont Sawmill, and provide an additional residual fuel stream for the biomass power facility.

6. Commitments and Contributions

These commitments represent a public statement of intent to participate in the project, to strive to identify opportunities and solutions whenever possible, to contribute assistance and support within resource limits, and to collaborate with other Team members in promoting the success of the project.

The Oregon Solutions Project team agrees to provide project policy oversight and to engage in efforts to enhance project visibility and acceptance.

The following commitments to the success of the project are made by the Project Team members:

Governor Theodore Kulongoski's Office

General Project Support and Policy Development

The Lakeview Project is an excellent example of a "lasting solution that simultaneously addresses economic, environmental, and community well-being," as stated in the Governor's 2003 Sustainability Executive Order. The Governor's Office created the Oregon Solutions approach to help address complex issues with sustainable solutions. To this end, Governor Kulongoski's Office will continue to support the Oregon Solutions Lakeview Project. In addition, the Governor has convened a blue ribbon work group from the public and private sectors to assess the barriers to financing and building forest biomass projects in Oregon. That work group has been charged with developing and coordinating proposed policy, in partnership with federal agencies, for long-term levelized small diameter timber supply from public and private lands, and more generally, finding solutions that simultaneously improve forest health, reduce wildfire risk, and benefit local economies. Furthermore, the Governor adopted a Renewable Energy Action Plan (REAP) for the state that identifies the development of forest biomass to energy as one priority. The Governor's Office will continue to work with state agencies and stakeholders to accomplish the goals set out in the REAP.

David Van't Hof, Sustainability Policy Advisor,
Governor Kulongoski's Office

Lakeview District Bureau of Land Management

The Lakeview District of the Bureau of Land Management, within constraints of available funding, will commit resources and personnel to:

- Participate in and support the development of a Coordinated Resource Offering Protocol (CROP) supply projection by providing data on juniper stand locations, volume, and size classes and other associated data to the contractor.
- Pursue the use of Stewardship Contracting Authorities in planning restoration of ecosystems where juniper encroachment has reached a point requiring treatment. The use of these long term contracting authorities may help level the supply.
- Work with collaborators to seek techniques for biomass removal that will minimize short term environmental damage.
- Participate on the ongoing Lakeview Biomass Implementation Team, which will meet once monthly in the Lakeview area.

Shirley Gammon

Shirley Gammon, District Manager
Lakeview BLM

Fremont-Winema National Forest

The Fremont-Winema National Forests, within the constraints of available funding, will commit resources and personnel to:

- <u>CROP Development:</u> participate in and support the development of Coordinated Resource Offering Protocol CROP supply projection:
  - Volume, species, size classes
  - Location of supply

  CROP will identify a minimum annual supply commitment.
- <u>Stewardship Authorities:</u> Pursue the use of stewardship authorities
  - to normalize annual supply of biomass – multi year contracts
  - facilitate the restoration of ecosystems and natural fire regimes – goods for services
- <u>Collaboration:</u> Work with collaborators:
  - for development of efficient small diameter trees extraction techniques
  - for the development of new markets for small diameter material
  - maintain involvement through the implementation phase of this project

Karen Shimamoto

Karen Shimamoto, Forest Supervisor
Fremont-Winema National Forests

Lake County

Lake County has always encouraged worthy productive projects for the benefit of the entire County. We readily assist projects by helping in planning and project permitting. Lake County is continually working for a long term solution for supplying the lumber mill and also the biomass plant when built.

JR Stewart, Commissioner
Lake County, Oregon

The Collins Companies

The Collins Companies commits the following support for the Lakeview Biomass project:

- Land Lease: Work with any energy developer on a land lease at our facility, The Fremont Sawmill in Lakeview, OR.
- Steam purchase: Work with any energy developer on a steam purchase agreement, taking the boiler at the Fremont Sawmill off line.
- Water: Provide access to an existing well on Fremont Sawmill property for the biomass plant usage.
- Sawmill Hogfuel: Negotiate the sale of hogfuel from the Fremont Sawmill to developer of Lakeview Biomass Plant.
- Chips: The Collins Companies will develop a long term contract to sell chips generated from normal logging operations at a negotiated price to the biomass plant.
- Log purchase: Should the biomass developer or a subsidiary fuel supply company be developed and long term contracts obtained by them from the Forest Service and BLM, the Collins Companies will purchase suitable sawlogs from them at a fair market value.

Paul Harlan, Vice President Resources
The Collins Companies

Oregon State University

Oregon State University will support the Lakeview Biomass Project in the following ways:

- Grants and Research: Seek grants to support research on major outcomes anticipated by implementation of the Project, including but not limited to water quality, fish and wildlife habitat, fire risk reduction, carbon sequestration, and biomass utilization.
- Project Implementation Assistance: Assist project implementers to secure scientific, technical, and educational assistance as requested.

Hal Salwasser, Dean
Oregon State University College of Forestry

Defenders of Wildlife

Defenders of Wildlife commits the following support for the Lakeview Biomass project:

- Long-Term Strategic Plan for the Lakeview Federal Stewardship Unit: Defenders will work with the Lakeview Stewardship Group to develop, publicize, and implement a long term strategy for the Lakeview Federal Stewardship Unit (Unit) that meets both the ecological and social goals of the Unit, as outlined in the 2001 reauthorization language.
- Outreach: Defenders will inform policy makers, media, and other environmental organizations of our support for an appropriately sized biomass facility that contributes to ecological sustainability of the Unit by utilizing biomass material generated as a by-product of restoration-oriented treatments consistent with the Long-Term Strategic Plan for the Unit.
- Monitoring: Defenders will work with the Lakeview Stewardship Group to encourage and help oversee environmental monitoring programs designed to gauge the effectiveness of thinning and other treatments in achieving restoration objectives.
- Treatment Regimes: Defenders will work with the Lakeview Stewardship Group to identify appropriate types, scale and location of restoration-oriented treatments to achieve objectives of the Long-Term Strategic Plan.

Richard T. Brown

Rick Brown, Senior Resource Specialist
Defenders of Wildlife

Lake County Resources Initiative

The Lake County Resources Initiative commits the following support for the Lakeview Biomass project:

- CROP/Supply Program Development: Work with COIC, Mater Engineering, the USDA Forest Service, the Bureau of Land Management, and other partners to create a sustainable long-term supply system focused on the Lakeview community.
- WESTCARB terrestrial carbon sequestration project: LCRI will provide local coordination between The Collins Companies, Jeld-Wen and Forest Service on this project.
- Goods for Services contracting: LCRI will work with The Collins Companies and Forest Service to gather field data off the Bull Stewardship Contract to verify economic assumptions utilized in the pro forma for the Lakeview Biomass Project.
- Long Term Strategic Plan for the Lakeview Federal Stewardship Unit: LCRI will work with the Lakeview Stewardship Group on a long term strategy for the Lakeview Federal Stewardship Unit that meets both the ecological and social goals of unit, as outlined in the 2002 reauthorization language.
- Pilot designation: LCRI will work with Sustainable Northwest and key congressional staff people on legislation for several pilots across the country to demonstrate biomass utilization.
- Energy Development Companies: LCRI will contact potential energy companies that can build and operate a biomass plant about locating a plant in Lakeview.
- Local Liaison: LCRI will serve as a liaison between energy company developer, The Collins Companies, and Federal, State and Local agencies for the purpose of establishing a biomass plant in Lakeview.
- Monitoring: LCRI will enter into a reciprocal agreement with COIC to share resources and findings regarding environmental, economic, community benefits, and programmatic monitoring related to CROP specifically and, as appropriate, ecosystem restoration projects in general.

Jim Walls, Executive Director
Lake County Resources Initiative

DG Energy Solutions LLC

DG Energy Solutions commits the following support for the Lakeview Biomass project:

- Support and guidance for Oregon Solutions: DG Energy Solutions has provided and will provide a dedicated executive to serve on the Oregon Solutions team assembled to support the Lakeview Biomass project effort, including providing first-hand knowledge of biomass project requirements, and participation in follow-up efforts as appropriate.

- Development Agreements: DG Energy Solutions has executed a preliminary development agreement with the Collins Companies for development of the Lakeview Biomass project on the site of The Fremont Sawmill in Lakeview, OR. DG Energy has drafted or executed detailed documents outlining the terms of provisions including Land Lease, Steam Purchase, Water Supply, Sawmill Waste, Chip Sale, and Log Purchase.
- Biomass Supply Study/CROP: DG Energy Solutions has arranged for the study of detailed biomass fuel supply, contracting with and providing the majority of funding for Mater Engineering to advance on matters critical to the development of a reliable fuel supply plan for the Lakeview Biomass project.
- Green Credits and Incentives: DG Energy Solutions will work with other Oregon Solutions team members to maximize and secure Business Energy Tax Credits, Renewable Energy Credits, Carbon Mitigation Credits, and other applicable local and federal production or investment tax credits to facilitate the development and financing of the Lakeview Biomass project.
- Project Implementation: DG Energy Solutions anticipates leading the advancement of the planning, permitting, design, commercial contracting, financing, construction and long term operation of the Lakeview Biomass project, bringing the majority of the equity capital required to develop and construct the project.

John Wood, Vice President
DG Energy Solutions, LLC

Town of Lakeview

The proposed Lakeview Biomass Plant will be located on Fremont Sawmill land both lying within the city limits of the Town of Lakeview. The Fremont Sawmill is a major employer and very important to the economic well being of the town. The Lakeview Biomass Project is a great economic opportunity for the town and we are here to support its reality in any manner we can. Restoring forest and range health are both environmentally and economically beneficial for the citizens of Lakeview, and to the Fremont Sawmill and the Lakeview Biomass Project.

- The Town of Lakeview will actively participate in Lakeview Biomass Project implementation team.
- As it deems appropriate, the Town will assist the Lakeview Biomass Project in seeking funding opportunities at the state and federal level.
- The Town Planning and Air Quality Committees will assist the project through the permit process.

Rick Watson, Mayor
Town of Lakeview

Central Oregon Intergovernmental Council

The Central Oregon Intergovernmental Council commits the following support for the Lakeview Biomass project through September, 2007 (support after this timeframe will be subject to additional funding availability):

- CROP/Supply Program Development: Subject to available funding, COIC will provide facilitation and technical assistance services, as needed, in association with LCRI, Mater Engineering, the USDA Forest Service, the Bureau of Land Management, and other partners to help create a sustainable long-term supply system focused on the Lakeview community.
- Monitoring: COIC will share available resources and findings regarding environmental, economic, community benefits, and programmatic monitoring related to CROP specifically and, as appropriate, ecosystem restoration projects in general.

Tom M. Moore, Executive Director
Central Oregon Intergovernmental Council

Oregon Natural Resources Council

As part of its mission to protect and restore Oregon's wildlands, wildlife and waters, ONRC is committed to the conservation and restoration of:

(1) *ponderosa pine and mixed conifer forests*, which have, as a result of logging, grazing and fire suppression, had their structure and composition degraded; and
(2) *sagebrush steppe*, which has suffered primarily from livestock grazing and fire suppression.

The reintroduction of natural fire regimes and modification of commercial logging and grazing practices are necessary to conserve and restore these forest and steppe ecosystems. Because of the unnatural build-up of small-diameter ponderosa pine, white fir and other tree species in forests and the invasion of western juniper into sagebrush steppe, it may be appropriate for large-scale, and intensive efforts to remove undesirable biomass from these ecosystems, using environmentally appropriate methods. In some cases, the reintroduction of fire without prior silvicultural treatment is appropriate. In other cases, the careful execution of a scientifically based thinning regimen is desirable before the reintroduction of fire. Any forest and steppe restoration regime must strictly conserve soil, water, biodiversity, roadless areas, and large and/or old trees.

The utilization of this surplus biomass material in the generation of electricity and steam can be consistent with such conservation and restoration. A power plant could also help diversify the southern Lake County economy, produce electricity from non-fossil fuel sources and can make industrial processes more efficient. In the short term, biomass energy generation could also improve the economics of forest and steppe restoration.

A biomass energy facility should be scaled to size and duration commensurate with the amount of material that is ecologically desirable and economically feasible to remove from the forest and the steppe over the next few decades. As forests and steppes are restored to again include a natural fire regime, unnatural increases of out-of-place trees and vegetation should be regulated more by fire than logging. Given the slow growth rates of vegetation in the area, it is neither feasible nor desirable, to consider large-scale cultivation of biomass on public or private lands to supply such a facility. However, over the next few decades, a biomass energy plant could reduce the large backlog of vegetation on public lands that has accumulated through previous mismanagement practices. Based on current information, it appears that the amount of available biomass that is ecologically desirable to remove from the forest and steppe is adequate to amortize the facility and indeed, to operate the facility for the length of its engineered design life

The establishment and implementation of a comprehensive landscape conservation and restoration strategy is essential for development of a successful biomass energy facility and the achievement of a stable biomass sale program. Such a plan would specify which areas are available for thinning to achieve forest and steppe restoration and which areas are not. By agreeing beforehand as to the conservation and restoration of the LFSU:

- local residents can know with confidence as to how much biomass is technically, economically, socially and politically available for energy production and job creation;
- timber interests can know with reasonable certainty how much timber will be available; and
- conservation interests can gain increased confidence that the LFSU is being managed for conservation and restoration across the landscape and over time.

In exchange for a permanent landscape conservation strategy that places roadless areas, old-growth trees and other key resources off-limits to commercial logging, ONRC will support and defend:

- efforts (including legislative) to improve the administration and planning of restoration projects and timber sales; and
- new strategies to adequately fund public land administration, environmental restoration projects and commercial timber sales that are restorative in nature.

Andy Kerr

Andy Kerr, Senior Counselor
Oregon Natural Resources Council

Oregon Department of Energy

Oregon Department of Energy (ODOE) will support the Lakeview Biomass Project in the following ways.

- Grants: ODOE will help identify appropriate grant sources and assist with writing or compiling grants to support planning, research and development of the project.
- Incentives: ODOE can provide expedited access to 35 percent Oregon Business Energy Tax Credits for non-federally funded portion of the biomass utilization project.
- Financing: ODOE can provided fixed-rate, fixed-term financing for the project up to a limit of $20 million dollars for an appropriately secured risk adequate for public bond underwriting.
- Technical Assistance: ODOE will provide data, analysis or help find others with information necessary to employ international best practices in biomass power facility design for optimized biomass use and highest return on investment.
- Communications: Upon request, ODOE will assist with communications, education or co-negotiation with federal, state or local government, utilities, consumers or neighboring public.

Michael Grainey, Director
Oregon Department of Energy

Energy Trust of Oregon

Energy Trust of Oregon's Strategic Plan includes a strong commitment to biomass energy, congruent with the Governor's *Renewable Energy Action Plan* and *Strategy for Greenhouse Gas Reduction*. We act on our commitment by investing in renewable energy projects that use eligible biomass resources to produce electric power for the benefit of Oregon customers of PGE and Pacific Power.

Forest and range biomass may be capable of playing a significant role in Oregon's clean energy future, provided that projects can be developed in an environmentally sustainable and economically viable manner. The time is right to explore this concept further.

To support the Lakeview Biomass Project, Energy Trust of Oregon makes the following commitment:

- Adam Serchuk, manager of Energy Trust's Biopower program, will serve on the Oregon Solutions team assembled to support the Lakeview effort, and participate in follow-up efforts as appropriate.
- When the project is closer to initial operation, Energy Trust will evaluate it as a potential recipient of funding through the Biopower or other appropriate program.

- To assist the development of the Lakeview project during 2006, Energy Trust will provide a 1:1 funding match to the Lake County Resources Initiative, up to a maximum Energy Trust contribution of twenty-five thousand dollars ($25,000), to support specific, discrete tasks that remove barriers to the project's viability.

Margie Harris 1/31/06

Margie Harris, Executive Director
Energy Trust of Oregon

Oregon Department of Environmental Quality

The Oregon Department of Environmental Quality (DEQ) will support the Lakeview Biomass Project in the following ways:

- Assist in developing and reviewing air emission data to assess the extent of net emission reductions of biomass power facilities as compared to wildfires and open burning (e.g. slash burning).
- Provide regulatory assistance to the biomass power facility and small diameter timber-utilizing businesses through DEQ's Business Response Team and participation on the South Central Economic Revitalization Team.
- Contribute assistance and support, within resource limits, and provide applicable DEQ data to the Lakeview Biomass Project Team.

Stephanie Hallock

Stephanie Hallock, Director
Oregon Department of Environmental Quality

Oregon Economic and Community Development Department

The Oregon Economic and Community Development Department (OECDD) will support the Lakeview Biomass Project in the following ways:

- Appoint Larry Holzgang, Business Development Officer, to act as the agency's primary representative and serve on the Oregon Solutions team for the duration of the project; and appoint Glenn Montgomery, Sustainable Business Liaison, to assist in a supporting role.
- Assist project partners in identifying and developing economically viable small diameter timber processing operations to support an adequate feedstock supply for the biomass power facility.
- Work with and through the Governor's Economic Revitalization Team to assist with regulatory streamlining of the proposed biomass facility.

- Evaluate the Lakeview Biomass Project as a priority project for funding through the Department's Business Development and/or Community Development programs and other strategic financing alternatives.

Lynn Beaton, Interim Deputy Director
Oregon Economic and Community Development Dept.

West Coast Regional Carbon Sequestration Partnership (WESTCARB)

The West Coast Regional Carbon Sequestration Partnership (WESTCARB) has identified that reducing wildland fire fuel loads and reducing stocking levels to improve forest vigor and long-term productivity as a regional opportunity in reducing carbon dioxide emissions through the avoidance of emissions from uncontrolled, catastrophic wildfire and through improved terrestrial sequestration and storage in the residual, fire resilient forests. WESTCARB supports the Lakeview Biomass Project because the project will conduct forest fuel and stocking treatments to improve forest vigor, health and fire resilience. Such action provides WESTCARB the opportunity to conduct research and technology development around the question of how can the carbon dioxide emission reduction benefits accruing to the residual, treated forestland be estimated, measured, monitored and reported to provide enough quality assurance regarding additional, permanent and reliable carbon offsets with no leakage and desired co-benefits such that the resultant offsets could be used to mitigate carbon dioxide emissions.

Specifically, WESTCARB plans to accomplish the following:

- <u>Develop Methodology for Determining Carbon Dioxide Emission Reduction Benefits for Fire Management</u> **–** The task consists of researching fire and fuel models, fire occurrence in western forests and impact of fires on carbon stocks both with and without fuel management treatment. The objective is to develop a baseline against which the carbon benefit of fuel management can be measured.

- <u>Coordinate Implementation of Fuel Management Plan</u> – In collaboration with participating landowner and resource management agencies, review and classify lands where fuel treatments will occur and coordinate the schedule and timing of fuel treatments to meet research and technology development needs.

- <u>Measure Carbon Dioxide Emission Reduction Benefits from Implementation</u> – Design measurement and monitoring plan for measuring carbon dioxide emission reduction benefits based on the volume of fuels removed and the resultant changes in fire behavior and severity and then measure and report carbon dioxide emission reduction benefits that are additional to the baseline estimate without fuel treatment.

- <u>Achieve Carbon Offset Market Recognition and Validation</u> – This task has four components: development of acceptable methods and procedures for reporting carbon benefits from changing fire management, preparation of necessary documentation to register all pilot project activities on the California Climate Action

Registry, review and acceptance of carbon benefits by available markets (e.g. DOE 1605(b) voluntary reporting, Climate Trust, Chicago Climate Exchange, etc.), and outreach.

WESTCARB is led by the California Energy Commission and funded in part by the U.S. Department of Energy National Energy Technology Laboratory's Regional Carbon Sequestration Partnership Program. The WESTCARB partners participating in the Lakeview Biomass Project are: Lake County Resources Initiative, Winrock International, Oregon State University, USDA Forest Service Pacific Northwest Research Station, Oregon Department of Forestry and the Oregon Forest Resources Institute. WESTCARB will provide this support through $1.19 million of U.S. Department of Energy funding to participating WESTCARB partners over a 4-year period beginning in federal Fiscal Year 2006. In addition, participating WESTCARB partners will be providing an additional $540,000 in matching, non-federal funds.

Larry Myer, Technical Director, WESTCARB
California Energy Commission

Sustainable Northwest

Sustainable Northwest (SNW) will support the Lakeview Biomass Project in the following ways:

1. Fundraising and Capacity Building: SNW will help identify, secure and leverage financial resources. SNW will also assist local community groups to expand their knowledge base and network of peers on topics related to biomass utilization and associated community development at an appropriate scale.
2. Secure Sustainable Supply of Biomass: SNW will share successful models of stewardship contracting facilitating effective restoration and associated biomass removal
3. Intermediate Small Diameter Processing: SNW will provide assistance to help design and implement an integrated utilization network that encourages highest value use for material removed. This assistance may include training, product development, individual business & business cluster development, and marketing services largely delivered through SNW's *Healthy Forests, Healthy Communities Partnership.*
4. Coordinated Federal Policy Development: SNW will work to engage the Lakeview Biomass Project in the *Rural Voices for Conservation Coalition*, a regional policy advocacy network.

Ryan Temple, Program Director
Sustainable Northwest

Klamath County Economic Development Association

The City of Klamath Falls, together with Klamath and Lake Counties, launched the Southern Oregon Climate Sustainability Project as a means of exploring the emissions reduction opportunities associated with a wide-ranging portfolio of project, programmatic, and behavioral measures. The project was formally launched during the summer of 2005 in anticipation of procuring CO2 mitigation funding from the proposed COB and PPM natural gas projects

Preliminarily, project proponents expect to deliver a minimum of 3,000,000 metric tons of CO2 over a 15-year contract period, reflecting a combination of CO2 emissions avoidance and sequestration measures. As emissions reductions accrue they will be reported to the Climate Trust. The Project will require a combination of up-front and pay-on-delivery funding, as specified in the full project proposal.

- Commitment: KCEDA agrees to include the Lakeview Biomass Project in the package of projects submitted to the Climate Trust for mitigation credits as part of the Southern Oregon Climate Sustainability Project. These credits will be determined at $/ton basis of carbon offsets.

L.H. Trey Senn, Executive Director
Klamath County Economic Development Association

The Wilderness Society

The Wilderness Society commits the following support for the Lakeview Biomass project:

- Long Term Strategic Plan for the Lakeview Federal Stewardship Unit: TWS will work with the Lakeview Stewardship Group to develop, publicize, and implement a long term strategy for the Lakeview Federal Stewardship Unit that meets both the ecological and social goals of the Unit, as outlined in the 2001 reauthorization language.
- Outreach: TWS will inform policy makers, media, and other environmental organizations of our support for an appropriately sized and ecologically sustainable biomass facility that utilizes biomass material generated as a by-product of restoration-oriented treatments consistent with the Long Term Strategic Plan for the Lakeview Federal Stewardship Unit.
- Monitoring: TWS will work with the Lakeview Stewardship Group to encourage and help oversee environmental monitoring programs designed to gauge the effectiveness of thinning and other treatments in achieving restoration objectives.

Michelle Ackerman, Pacific Northwest Regional Director
The Wilderness Society

3EStrategies / Business Alliance for Sustainable Energy

3EStrategies, through our Business Alliance for Sustainable Energy project will continue to support the Lakeview Biomass Energy Facility through the following measures. The degree of this support will be contingent upon funding availability.

- Networking and Liaison Services: 3EStrategies will continue to assist in convening the various stakeholders necessary for successful implementation of this project. 3EStrategies will aid LCRI in strategically working with elected officials, economic development interests and the media.
- Educational Leveraging: 3EStrategies will assist LCRI in documenting the process and outcomes of this project and creating educational materials to fully capitalize on the pilot project and model potential of this project.
- Connection to Larger Sustainable Energy Industry: 3EStrategies will assist the Lakeview Biomass Energy Facility in staying well positioned within the larger sustainable energy industry so as to effectively harness political and economic development leveraging opportunities.

Cylvia Hayes, Executive Director
3EStrategies

Oregon Department of Forestry

The Oregon Department of Forestry and the Klamath-Lake District will work with LCRI acting as a conduit of information regarding opportunities for private landowners and others to participate in the Lakeview Biomass Project. This will include distributing print and other material relating to biomass, and helping in developing and announcing meetings.

Greg Pittman, Lake Unit Forester
Oregon Department of Forestry

The South Central Oregon Economic Development District (SCOEDD)

SCOEDD supports the Lakeview Biomass Project and will work with LCRI in the future, as they have in the past, to do part in helping to ensure the proposed power plant is a successful project. An integral part of the Klamath and Lake County Regions strategy encourages the development of renewable energy and natural resource based projects. The Lakeview Biomass Project supports both of those aspects of the strategy.

Andrew Stuedli
South Central Oregon Economic Development District

Appendices

Appendix A. Glossary

economically viable
A market, product, or business in which an acceptable return on investment is derived over an acceptable timeframe.

(Source: COPWRR Steering Committee)

ecosystem, forest, or rangeland health
A condition where the parts and functions of an ecosystem are sustained over time and where the system's capacity for self-repair is maintained, such that goals for uses, values, and services of the ecosystem are met.

One of the signs of a healthy ecosystem in good working order is its ability to respond to disturbances such as fires, insects, or floods in a dynamic way. The system absorbs and recovers from disturbances without losing its processes or functions, although recovery may take varying amounts of time, or specific conditions may look different afterward. If the ecosystem is healthy, it will continue to produce populations of plants and animals that are diverse and viable, waters that are clear, air that is clean, and soils that remain productive.

(Source: Adapted from ICBEMP Draft EIS)

regional forest and rangeland biomass *inventory*
The total stock of biomass currently present on forest and rangelands in a defined region and/or, given growth rates and expected disturbances expectations, the total stock of biomass anticipated to be available annually over a period of time (e.g. 20 years).

(Source: OS Staff)

regional forest and rangeland biomass *supply*
A subset of biomass inventory: the annual volume of biomass from forest and rangelands in a defined region that, given economic (e.g. harvest and transportation costs, land management budgets, etc.), biophysical (e.g. sensitive habitats, steep slopes, etc.), and political considerations (e.g. Wilderness Areas, appeals, local community expectations, etc.) can be reasonably expected to be made available for utilization.

(Source: OS Staff)

sustainability
Using, developing and protecting our social, economic and environmental resources in a way, and at a rate, that enables people to meet their current needs without compromising the ability of future generations to meet their needs. It means increasing economic opportunities and improving social conditions by employing environmentally sound measures.

(Source: 3EStrategies)

Appendix B. Project Team Ground Rules

At their first meeting on May 12, 2005, the Oregon Solutions Project Team agreed to adopt the following Ground Rules for Collaboration:

General Principles

- We agree to approach problems with humility and adaptability. We will inevitably make mistakes and we will learn from these mistakes, make corrections, and not place blame.
- We recognize that we each have a unique perspective and contribution to make, whether it is expertise, labor, money, in-kind services, etc.
- We recognize that we must endeavor to involve any person or group who could help or hinder us to achieve our goals.
- We agree to focus on taking incremental "do-able" steps towards success.

Ground Rules

1. We recognize that the best outcome depends upon cooperation and collaboration by all entities at the table.
2. We commit to openly communicate ideas, potential contributions, and concerns, and also commit to engage in respectful, active listening to each other.
3. We are willing to creatively explore solutions.
4. We agree to commit to the agreed-upon solution, in whatever way we can. If we, individually, are unable to make a commitment for our organization, we will work to identify the person that can and determine if the commitment is possible.
5. We commit to building trust by doing what we say we will do, over and over.
6. We agree to notify each other before taking outside actions that might impact the process. (This does not mean that we will provide information that it would be inappropriate to share in a public venue.)
7. We agree that everyone shares in the solution, everyone shares in the credit.
8. The co-conveners and project staff commit to ensuring that this process does not result in "just a bunch of meetings."

Appendix C. Project Team Member List

First Name	Last Name	Company	Phone	Email Address
Mike	Anderson	The Wilderness Society	206-624-6430	MAnderson@twsnw.org
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Rick	Brown	Defenders of Wildlife	503-697-3222	rbrown@defenders.org
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Cylvia	Hayes	3E Strategies	541-617-9013	info@3estrategies.org
Doug	Heiken	Oregon Natural Resources Council		dh@onrc.org
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Rick	Rine	Fremont and Winema National Forests	541-947-6205	rrine@fs.fed.us
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Chuck	Wells	Friends of Fremont/Winema	541-783-2866	cswells@alwaysonnetworks.com
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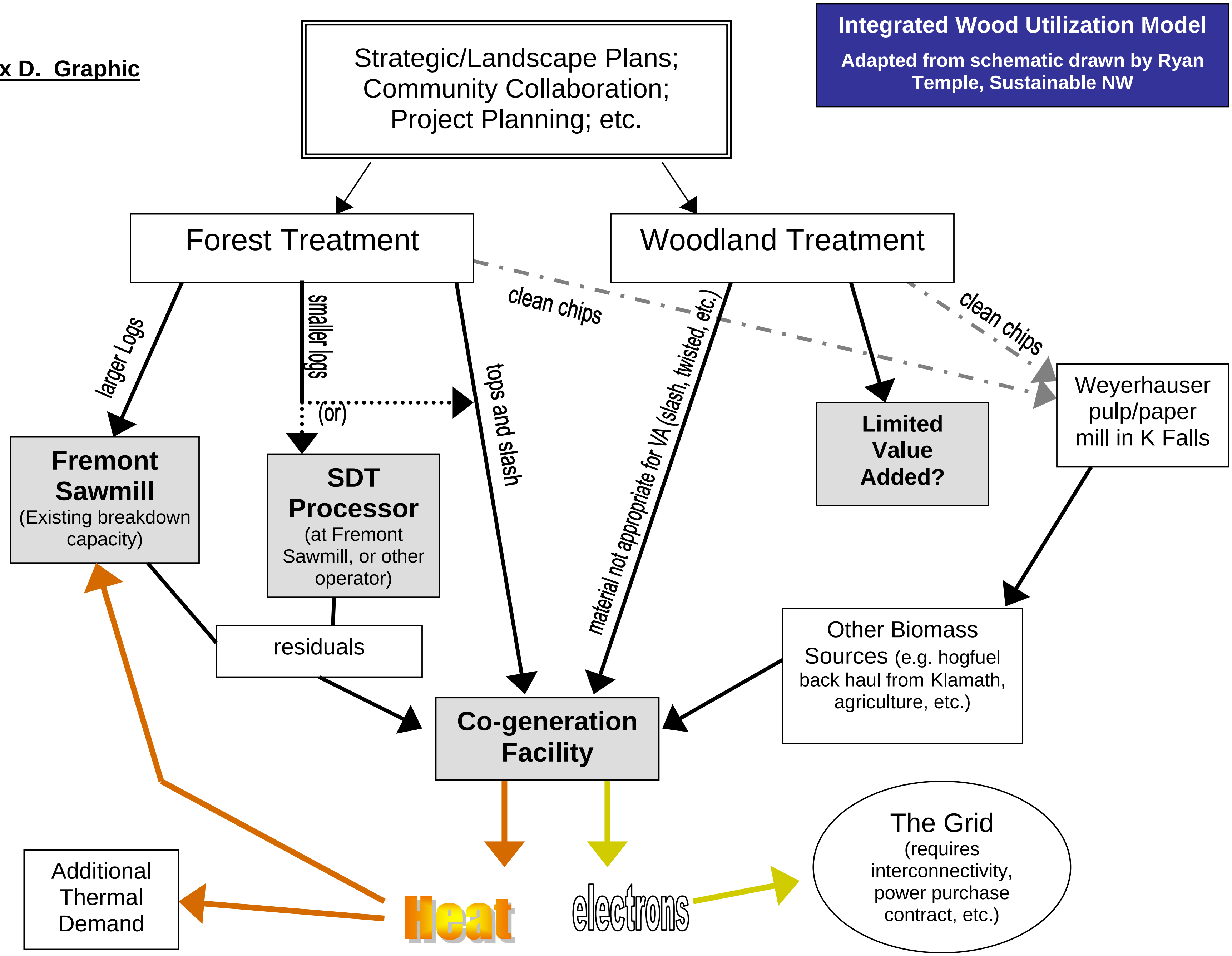
John	Wood	DG Energy Solutions, LLC	619-398-8446	John Wood <jwood@dg-energy.com>

Appendix D. Graphic



Appendix E. Implementation Plan

TASK OR CATEGORY	RESPONSIBLE PARTIES	TIME FRAME	POTENTIAL SUPPORTING ROLES
I. STAKEHOLDER COLLABORATION AND COMMUNITY ENGAGEMENT			
1) Identify "Ideal" Desired Future Condition; To help identify ideal treatment levels, regardless of current budgets, lack of markets, etc.	Public Land Agencies; Lakeview Stewardship Group, LCRI, Implementation Team	2006/2007	▪ COIC/The Nature Conservancy FLN process under way in Central OR. ▪ Planning resources ▪ Foundations
2) Ongoing Monitoring; Support existing monitoring effort, which may be threatened due to loss of Title II dollars. Ensure adaptive management by applying findings to practice (knowledge and technology transfer and uptake). Focus monitoring efforts on stewardship contracts, which already require it.	LCRI Implementation Team Lakeview Stewardship Group	Ongoing	▪ Lakeview Stewardship Group ▪ COIC – existing process in Central Oregon ▪ OSU, other research institutions
3) Community Outreach; Hold community and stakeholder meetings	LCRI, Public land Agencies	Ongoing	▪ Implementation Team
4) Pursue External Networks and Partnerships; Continue to work with external networks to leverage resources and share information	LCRI, Implementation Team, Lakeview Stewardship Group	Ongoing	▪ COIC/CROP ▪ BASE ▪ Sustainable NW
II. SUPPLY, SCALE, DESIGN			
1a) Perform CROP Supply Analysis; Identify supply most likely to be made available over at least a five year period, by at least species, diameter class, and source.	Mater Engineering; Fremont-Winema National Forest; Lakeview BLM (heretofore "public land agencies"); CA/NV USFS and BLM units; private sources	Fall/Winter 2005/2006	▪ COIC can help with next steps for CROP (e.g. database) ▪ DG Energy ▪ Energy Trust of OR
1b) Analyze projections; create Resource Offering Maps and apply business sensitivity/risk analysis to generate conservative estimates of supply.	Mater Engineering, DG Energy, other interested businesses	Winter/ Spring 2006	▪ Input/assistance from public land agencies, LCRI ▪ Implemen. Team

TASK OR CATEGORY	RESPONSIBLE PARTIES	TIME FRAME	POTENTIAL SUPPORTING ROLES
2) Appropriate Harvest Techniques; Support the development and utilization of ecologically-friendly extraction techniques suited to harvest and removal of small diameter material	Public land agencies; LCRI, Lakeview Stewardship Group	Spring 2006 – ongoing (monitoring)	▪ Research grants; OSU; other institutions ▪ Implementation Team ▪ Foundations ▪ USFS Equipment Development Ctrs.
3) Develop Public Land Supply; Develop stewardship contracts and other biomass contracts.	Fremont-Winema NFs, Lakeview BLM, LCRI, Implementation Team	Winter 2006 - ongoing	▪ Knowledge transfer/etc. from stewardship contracts around the country[2] ▪ Governor's Office ▪ ODF
4) Identify Sustainable Scale of Facility; based on work accomplished in tasks I.1-3, supply feasibility and costs, and business and power market considerations, etc.	DG Energy, Implementation Team, Lakeview Stewardship Group	Spring-Summer 2006	
5) Design Facility; Select technology (e.g. gasification vs. incineration).	DG Energy	as per DG timeline	
6) Funding for Supply; Develop additional resources to secure supply.[3]	Implementation Group, other beneficiaries of restoration work (e.g. communities, other agencies); Fremont-Winema NFs, LCRI.	Winter, 2006 - ongoing	▪ Foundations ▪ OR Delegation

[2] For example, the White Mountain stewardship project in Arizona helped to stimulate a biomass power facility.
[3] Including, potentially, the use of special legislation to reduce costs and increase funding as outlined in the ONRC support statement.

TASK OR CATEGORY	RESPONSIBLE PARTIES	TIME FRAME	POTENTIAL SUPPORTING ROLES
7) Secure Supply; Decide who will bid on the public land supply. Also develop and secure private land supply, waste stream sources, etc.	Collins Companies, DG Energy, LCRI	Winter, 2006 - ongoing	▪ Implementation Team ▪ ODF via SB 1072 (?) ▪ ODF could assist with private land supply
III. ASSOCIATED EC0NOMIC OPPORTUNITIES			
1) Develop an Economic Development Strategy; including a short list of SDT processing opportunities suitable to CROP-identified supply and supply costs.	LCRI; Implementation Team; Collins Companies; DG; local businesses; Chamber	February – Aug. 2006	▪ OECDD ▪ EDA ▪ USDA Forest Products Lab ▪ OSU College of Forestry ▪ Sustainable NW
2) Market Opportunities; If necessary (if local operators don't initiate on their own)	LCRI, DG Energy, Implementation Team	Summer-Fall 2006	▪ Sustainable NW ▪ OECDD ▪ KCEDA ▪ BASE
3) Secure Investments	LCRI, DG Energy	Summer-Fall 2006	▪ KCEDA ▪ OECDD ▪ BASE ▪ Collins Companies
4) Negotiate waste heat purchase by Fremont Sawmill	DG Energy, Collins Companies	Spring-Summer 2006	
5) Market Excess Waste Heat; Depending upon power facility capacity and volume required by Collins, ID additional waste heat capacity and market it.	DG Energy, LCRI	Spring-Summer 2006	▪ Tempo Foam, or other businesses ▪ OECDD ▪ KCEDA
6) Market Other By-Products; ash, etc.	DG Energy, LCRI	Spring-Summer 2006	▪ OECDD ▪ KCEDA

TASK OR CATEGORY	RESPONSIBLE PARTIES	TIME FRAME	POTENTIAL SUPPORTING ROLES
IV. POWER PURCHASE AGREEMENT AND INTERCONNECTION			
1) Negotiate Power Purchase Agreement/Sales Contract	DG Energy, Utility	as per DG timeline	▪ BASE ▪ Governor's Office ▪ LCRI
2) Negotiate Interconnection; Companies/model depends on the power purchaser	DG Energy, Utility, local utility (if required)	Upon completion of task III.1	
V. CREDITS AND INCENTIVES			
1) Secure Business Energy Tax Credit and Production Tax Credit	DG Energy, ODOE	as per DG timeline	▪ Energy Trust
2) Secure Business Development Incentives; including Enterprise Zone and Small City Income Tax Exemption	DG Energy, Lake County, OECDD	as per DG timeline	
3) Apply for Energy Trust Biomass RFP	DG Energy	as per DG timeline	▪ Energy Trust[4]
4) Secure Carbon Mitigation Credits for Direct Fossil Fuel Displacement at Facility	KCEDA, DG Energy, LCRI	as per DG timeline	▪ Climate Trust
5) ID Carbon Mitigation Credit Potential for Fuel Treatment Mitigation of Uncharacteristically Severe Wildfires	WESTCARB	2009(?)	▪ LCRI ▪ Climate Trust
6) Other Initiatives – e.g. designation of the Lakeview project as a pilot under the Governor's REAP	Depends on the initiative	ongoing	
VI. PERMITTING			
1) Secure Air Quality Permits	DG Energy, ODEQ	as per DG timeline	▪ With assistance of DEQ's Business Response Team
2) Secure Land Use Permits	DG Energy, City/County	as per DG timeline	

[4] ETO is agreeing to provide up to $25,000 in 1:1 match funds to help develop this project to become competitive for the RFP process.

TASK OR CATEGORY	RESPONSIBLE PARTIES	TIME FRAME	POTENTIAL SUPPORTING ROLES
VII. IMPLEMENTATION TEAM			
1) Develop Implementation Team, Tasks, and Meeting Schedule; this team will take on the resolution of outstanding multi-stakeholder issues – including supply, ecologically-sensitive harvesting techniques, SDT processing opportunities, develop additional treatment funds, etc (Team is listed in appropriate places above). An early task should be to revisit this Implementation Plan.	LCRI (team coordinator), Public Land Agencies, DG Energy, ODF, Collins Companies, Lakeview Stewardship Group/Environmental Group	After DOC Signing through completion	▪ BASE ▪ COIC ▪ Others

Appendix F. Background Reports, Documentation, Existing Efforts

(Placeholder)

- o Reauthorization of the Lakeview Federal Sustained Yield Unit;
- o Lakeview Stewardship Group collaborative effort since 1998;
- o Long Range Strategy for the Lakeview Federal Stewardship Unit,
- o Lakeview Biomass Feasibility Study;
- o WESTCARB Grant;
- o University of Washington Study;
- o Investigation of Alternative Strategies for Design, Layout and Administration of Fuel Removal Projects;
- o LCRI Monitoring program.

APPENDIX F:
Theodore R. Kulongoski Governor's Letter

THEODORE R. KULONGOSKI
Governor

January 10, 2005

Jim Walls, Executive Director Lake
County Resources Initiative 25 North
E St., Suite 3 Lakeview, OR 97630

Dear Jim,

I received your request that the Lakeview Biomass Project be designated an Oregon Solutions project. After reviewing your letter, I believe that the project supports Oregon's economic, social, and environmental objectives and would like to designate the Lakeview Biomass Project as an Oregon Solutions project and appoint Hal Salwasser as the project Convener.

I am pleased to hear this project will support forest health with a management plan for ecological restoration of the forest while also creating an opportunity for economic growth in the area. By collaborating with public and private partners using the Oregon Solutions process, the Lakeview Biomass Project has the potential to become a model for other communities across the state.

The Oregon Solutions approach will help you to overcome potential impediments early on and bring effective partners to the table to integrate resources for successful implementation. Oregon Solutions staff will also help you assemble a team of public and private partners to develop an integrated strategy, and to sign a "Declaration of Cooperation" for the project.

I am enthusiastic about the potential of this project. Please keep me updated on the progress.

Sincerely,

THEODORE R.
KUL/3NGOSKI
Governor

TRK:m/mfe

cc: Hal Salwasser, Dean of the College of Forestry, OSU
David Van't Hof, Governor's Sustainability Advisor
Merriesue Carlson, Governor's Economic Revitalization Team Coordinator
Pete Dalke, Oregon Solutions
Business Alliance for Sustainable Energy
Ray Naff, Governor's Intergovernmental Relations Director

APPENDIX G:
Preliminary Assessment of the Economic Impacts of the Collins Pine and Biomass Facility Project on Lake County January 2010

Preliminary Assessment of the Economic Impacts of the Collins Pine and Biomass Facility Project on Lake County
January 2010

Michael Anderson, Economist
(503) 229-6179
michael.w.anderson@state.or.us

Oregon Business Development Department
Global Industry Strategies
121 S.W. Salmon
Portland, OR 97204

Project Specifications[1]

<u>Project Description</u>

Collins Pine

- Retention of 65 jobs at Collins Pine sawmill

Biomass Facility

- Construction of a $70 million biomass facility
- Creation of 60 logging jobs to provide the feedstock for the biomass facility
- Creation of 10 sawmill jobs at the biomass facility
- Creation of 8 power generation jobs at the biomass facility

The following assumptions are made in analyzing the economic impact of the project on Lake County's economy:

- The company's inputs will originate from Oregon and workers filling the positions will reside within Oregon.
- The company's investments will not displace other investments in Lake County but instead will add to the total stock of economic activity in the county.
- The total biomass investment value of $70 million is not used in the model. A $70 million investment will support 250 direct jobs (IMPLAN implied sales equal $35 million) and $45 million in equipment purchases.

Methodology

This analysis considers the impact of investment and direct jobs created by the retention of Collins Pine and the construction of a biomass facility on total employment, labor income (wages), and state personal income tax. The total impact is the sum of the following three impacts:

- Direct Impact: impacts associated with the company's employment and wages
- Indirect Impact: impacts resulting from suppliers to the company
- Induced Impact: impacts resulting from purchases made with income earned from the company and its suppliers

To estimate the project's impact on personal income taxes, an effective state personal income tax rate of 5.67% is used to calculate the total tax revenue generated by this project. This rate is based on 2007 personal income tax estimates generated by the Oregon Department of Revenue. Although this rate is significantly lower than highest marginal personal income tax rate of 9%, it represents the actual share of a household's adjusted gross income that is ultimately received by the Oregon Department of Revenue.

[1] Data provided by Larry Holzgang on January 14, 2010.

Collins Pine Impacts

Table 1. Employment

Project	Direct	Indirect	Induced	Total
Collins Pine	65	29	15	110

Source: IMPLAN (2008, Lake County, Oregon

Table 2. Labor Income (Wages)

Project	Direct	Indirect	Induced	Total
Collins Pine	$4,267,046	$1,598,825	$388,000	$6,253,871

Source: IMPLAN (2008, Lake County, Oregon

Table 3. Estimated Personal Income Taxes*

Impact Type	Direct	Indirect	Induced	Total
Collins Pine	$241,942	$90,653	$22,000	$354,594

Source: IMPLAN (2008, Lake County, Oregon
*Based on a 2007 average effective income tax rate of 5.67%. Author's calculations based on Oregon Department of Revenue personal income tax data.

Biomass Facility Impacts

Table 4. Employment

Impact Type	Direct	Indirect	Induced	Total
Construction	250	36	30	316
Logging	60	18	13	91
Sawmill	10	5	2	17
Electricity Generation	8	1	3	12
Total	328	59	47	435

Source: IMPLAN (2008, Lake County, Oregon

Table 5. Labor Income (Wages)

Impact Type	Direct	Indirect	Induced	Total
Construction	$8,966,995	$1,571,861	$743,569	$11,282,430
Logging	$3,642,292	$966,130	$316,401	$4,924,823
Sawmill	$656,469	$245,973	$59,692	$962,134
Electricity Generation	$968,761	$27,598	$68,666	$1,065,025
Total	$14,234,517	$2,811,562	$1,188,328	$18,234,412

Source: IMPLAN (2008, Lake County, Oregon

Table 6. Estimated Personal Income Taxes*

Impact Type	Direct	Indirect	Induced	Total
Construction	$508,429	$89,125	$42,160	$639,714
Logging	$206,518	$54,780	$17,940	$279,237
Sawmill	$37,222	$13,947	$3,385	$54,553
Electricity Generation	$54,929	$1,565	$3,893	$60,387
Total	$807,097	$159,416	$67,378	$1,033,891

Source: IMPLAN (2008, Lake County, Oregon

*Based on a 2007 average effective income tax rate of 5.67%. Author's calculations based on Oregon Department of Revenue personal income tax data.

Combined Project Impacts

Table 7. Employment

Impact Type	Direct	Indirect	Induced	Total
Collins Pine	65	29	15	110
Biomass	328	59	47	435
Total	393	89	63	544

Source: IMPLAN (2008, Lake County, Oregon

Table 8. Labor Income (Wages)

Impact Type	Direct	Indirect	Induced	Total
Collins Pine	$4,267,046	$1,598,825	$388,000	$6,253,871
Biomass	$14,234,517	$2,811,562	$1,188,328	$18,234,412
Total	$18,501,563	$4,410,387	$1,576,328	$24,488,283

Source: IMPLAN (2008, Lake County, Oregon

Table 9. Estimated Personal Income Tax*

Impact Type	Direct	Indirect	Induced	Total
Collins Pine	$241,942	$90,653	$22,000	$354,594
Biomass	$807,097	$159,416	$67,378	$1,033,891
Total	$1,049,039	$250,069	$89,378	$1,388,486

Source: IMPLAN (2008, Lake County, Oregon

*Based on a 2007 average effective income tax rate of 5.67%. Author's calculations based on Oregon Department of Revenue personal income tax data.